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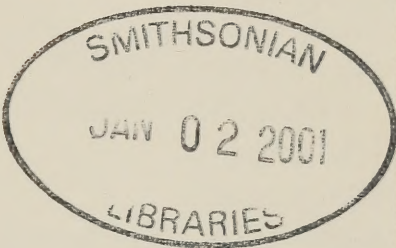
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ACADEMY OFFICE

Washington Academy of Sciences
Room 811

1200 New York Ave., N. W.

Washington, DC 20005

Phone (202) 326-8975

FAX (202) 289-4950

Email was@aaas.org

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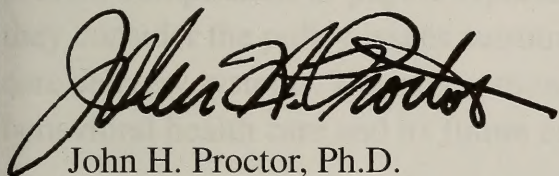
November 5, 1998

Special Centennial Issue of the Washington Academy of Science

From time to time over the past century, the Washington Academy of Sciences has occasionally published works on science and technology which it's then leaders felt gave voice to important questions or issues. This special issue is one of those occasions.

Within the theme of our centennial year, "Communications, Past Present, and Future – Within and Among Entities in the Biological Hierarchy of Life," the papers in this volume are devoted to health care, particularly behavioral health care. Which system of health care is best, sustainable, and affordable for in the next century is discussed by many and concerns all Americans.

Our thanks to Fellow and Past President, Dr. Ronald W. Manderscheid for assembling these papers and to the over 100 authors for sharing their work; and to Fellow Thomas Bottegai and his editorial board.

A handwritten signature in black ink, reading "John H. Proctor". The signature is fluid and cursive, with a long horizontal stroke at the end.

John H. Proctor, Ph.D.
Centennial Chair

Introduction

Special Centennial Issue

Washington Academy of Sciences

As we move into the future, a greater focus will be given to how health care delivery is organized into large scale systems. With the advent of managed behavioral health care, this concern has become pronounced because of the potential for limiting access to care. Enhanced communication among policy makers, payers of health care, health care providers and health care recipients is critical to our understanding and advancement of the behavioral health care field.

Since its inception, the *Journal of the Washington Academy of Sciences* has carried a broad array of scientific findings applicable to the practice of medical science. The present compilation of papers represents the concerns of these major stakeholders as they consider the policy issues surrounding the increased focus on the organization of care delivery systems. The expectation is that these papers will foster a dialogue around behavioral health care and its future course.

Marilyn J. Henderson and Ronald W. Manderscheid

Facing our Future Together: Policy Perspectives on Behavioral Health Care

A collection of papers prepared for a Special Centennial Edition of the
Journal of the Washington Academy of Sciences

Edited by

Marilyn J. Henderson
Sarah L. Minden
Susan Foster
Ronald W. Manderscheid

September 1998

Policy Analyses for Transition to Health Care Reform

**Marilyn J. Henderson, Sarah Minden,
Susan Foster, Ronald W. Manderscheid**

Introduction

The rapid expansion of managed care from the private to the public sector created a critical need for an analysis of the issues confronting the behavioral health care field and suggestions for future directions. In the Fall of 1996, the Survey and Analysis Branch, Division of State and Community Systems Development, Center for Mental Health Services (CMHS) undertook a 2-year contract with Abt Associates to conduct a series of focus groups and analyses to improve our understanding of the major managed behavioral health care issues facing the field.

The project had several key components. The fact-finding phase consisted of an extensive review of published and unpublished literature that illuminated key policy issues in an era of transition from fee-for-service to managed behavioral health care (Minden and Hassol, 1996); a series of 2-day focus group sessions with major stakeholders in behavioral health care — consumers, family members, providers, managed care organizations (MCOs), State mental health agencies, and insurers — that discussed the current state of affairs in the public and private sectors (Foster and Minden, 1997); and a technical expert workgroup that discussed current status of and future needs for data collection, measurement, and information systems within the managed care context (Wurster, 1997).

The literature review, focus groups, and expert workgroup generated topics for 10 policy papers. These papers describe the state of the art in the various content areas and recommend next steps toward improving the quality of care for persons with mental illness. Each paper draws from the published and unpublished literature, as well as the earlier focus group discussions, but is based primarily on the opinions of expert panelists who convened to formulate the paper. The panelists participated in a 2-hour discussion facilitated by the lead writer(s) and commented on the resultant draft papers. In several cases, extensive conversations were held with individual experts around particular comments and issues (Foster and Minden, 1998). This special issue of the Journal contains the 10 policy papers that resulted from the 2-year project. For each paper, the facilitator/lead writer(s) are listed first, followed by the expert panelists and CMHS program staff in alphabetical order.

The current paper provides a synopsis of the basic findings from this 2-year project, the major issues that surfaced, and the needed next steps. It closes with a discussion of ongoing and planned activities to advance the development of quality assessment for behavioral health care, one of the areas identified by many participants as needing immediate attention.

Terminology

The literature review, focus groups, and policy papers all demonstrated the absence of a uniform and consistent terminology for describing the new structures and procedures that have emerged in this time of transition. Consider, for example, managed care organization, managed behavioral care organization, managed behavioral health care (or, healthcare) organization, MCO, MBCO, and MBHCO. The papers reflect this diversity of terminology. Below we discuss some of the key terms used in this special issue.

Agency and authority. The terms “agency” and “authority” are often used interchangeably. The state, county or local mental health authority performs two distinct functions: first, it operates facilities such as state hospitals and provides community-based services such as housing, rehabilitation, and clinical care to some of its citizens; second, it is responsible for the nature and quality of the care available to all its citizens, whether received in the public or private sector. In performing the first function, we think of the public mental health authority as an “agency,” implementing a variety of mandated activities. In its second function, it manifests its “authority” to make rules and to review and monitor the activities of others to ensure compliance and preservation of the public good. Over time, the distinction between these two terms has blurred. We use “MHA” to refer to the mental health agency/authority, and “Medicaid” or “Medicaid agency” to refer to the single state agency that implements activities mandated by and operates under requirements set by the Health Care Financing Administration (HCFA).

Because states vary so widely in how their mental health care systems are structured and function, we use the term “MHA” to include state, county, and municipal MHAs who pay for coverage or purchase services on behalf of public mental health beneficiaries or consumers. We use “director” for the head of the MHA even though many states call this person “commissioner.”

Consumers. Individuals who are or have been involved in the mental health service system use various terms to describe themselves, such as consumers, survivors, ex-patients, patients, clients, or recipients. While respecting individual preference, we use the term “consumer” in this report since it implies the use of services and also reflects the trend toward increased respect for the consumer’s point of view.

Mental and Behavioral. Stakeholders engage in lively debate over these terms, tending to find one or the other unacceptable. The term “behavioral” was introduced as a term that includes both substance abuse and mental health problems. While most of the papers that follow focus primarily on mental health issues, many of them include this broader

perspective. Hence, authors use both terms.

Provider and Clinician. While “clinician” always refers to a person who provides clinical services (e.g., a psychiatrist, psychologist, social worker, or nurse), “provider” can be used to refer to a single clinician or to a group of clinicians who, together, constitute a single entity that provides clinical services. “Provider” in the latter usage appears in contracts for service delivery; it also is used to describe the public MHA as “the provider of last resort.” We use only “provider” to describe groups and entities that deliver services; and “clinician” and “provider,” interchangeably, for individuals.

Results from the Fact-Finding Phase

Participation

All focus groups stressed the need for a participatory approach to decision making within managed care. They made it clear that all major stakeholders, particularly consumers and family members, must play substantive and meaningful roles in structuring and monitoring systems of care and in delivery of individual treatment. In order to assure quality care with adequate resources, the various behavioral health care stakeholders need to communicate clearly with one another, and work through issues as a team. All groups expressed an interest in continuing to find opportunities to discuss and collaborate on health care issues.

Quality of care

All focus groups emphasized quality of care, particularly the need for better outcome measures, practice guidelines, and provider monitoring. They agreed that more work is needed to develop clinical, person-directed (or -centered) outcome measures with substantial uniformity across States and systems. Most groups wanted national-level practice guidelines that would reflect individuals and their needs while still providing comparable guidelines across systems. The extent of this flexibility within guidelines was a source of tension in some groups.

Numerous issues abound in how to design, test, and move these quality measurement systems forward in a timely way. Groups discussed the importance of developing measurement tools as well as ways to pay for the development, testing and collection of data and the data systems needed to support them, while stressing that this should be done without reducing resources available for services.

Vulnerable populations

People who are particularly at risk require special attention. All focus groups agreed that there should be a safety net mechanism but did not reach consensus on the roles and responsibilities of the various levels of government. They highlighted the need for

culturally relevant services and for intensive services for individuals at high risk of falling through the cracks of the care system. The literature review addressed this issue by examining research on services for vulnerable populations and how the transition to managed care might fail to meet their needs for comprehensive, integrated, long-range, individualized services. It highlighted the importance of intensive case management in the care of people with serious mental illness.

Contracting

Public sector contracting, including both the content and process of contracting, were areas of great concern to all focus groups. Public sector contracts are one of the major determinants of the shape and scope of services available to public sector consumers, who are often those most in need of care. Groups identified short-term contracting as a major problem and noted that State and local governments need more expertise and technical assistance in the contracting arena. Major points of discussion centered around the openness of the contract process to the public and the need for involvement of stakeholders, particularly consumer groups, in contract design, negotiation, and monitoring. The technical workgroup concluded that the contracting process should include language about data requirements to ensure that data are available and accessible to consumers and other stakeholders in need of information. The literature review summarized several important unpublished reports on contracting issues.

Service coordination and integration

Many of the focus groups saw coordination between mental health and medical care as necessary to reduce fragmentation and cost-shifting. From a clinical perspective, coordination was seen as especially desirable for mental health and substance abuse agencies. Also noted was the need for better coordination and communication between the criminal justice system and mental health services and for increased education of justice and school personnel. The groups recommended increased ability to communicate effectively across the systems with respect to records and funding.

Although coordination and integration were identified as critical elements of a good service system, many were concerned that mental health issues might be lost within an integrated framework. Data are needed across systems to monitor the impact of managed care on comprehensive support services, since typically they are not provided by managed behavioral health care. The research on integrated services including demonstration projects and evaluations of integrated service systems, was summarized in the literature review.

Provider competencies

A well-trained workforce that can negotiate the system effectively and provide ethical, high-quality treatment to persons in need was identified as a critical requirement. Where

providers are to come from and who will finance their training was an area of concern. Groups noted a need for developing providers with specialized clinical and language skills to provide care for consumers of all cultural and linguistic groups.

Consumer-run services

Consumer-run services are clearly used and needed. Accreditation and reimbursement are major concerns, and tension exists between a desire for legitimacy within the system and maintaining the essential qualities of consumer-run services that make them a desirable and critical care component.

Information needs

Each focus group and the literature review recognized the need for high-quality, accessible information to enable an assessment of the impacts of managed care on the behavioral health care field. The technical workgroup (Wurster, 1997) specifically recommended that immediate attention be given to a revision of the current MHSIP data standards in FN-10 (Leginski et al., 1989) and the recommended children data standards (MHSIP, 1992). They noted two papers addressing person-centered decision support systems (Campbell and Frey, 1993; Buckley, 1993) as foundations. They also recommended development of uniform outcome data for service systems and development and testing of performance measures within the MHSIP Consumer-Oriented Report Card. Confidentiality of individual consumer information is a critical issue that must be addressed in the development and implementation of data systems. Similar issues were raised in the literature review.

Findings from the Policy Papers

Consumer Issues in Managed Behavioral Health Care - M. Auslander, et al.

Changes in the delivery of public mental health services present both opportunities and risks for consumers of managed behavioral health care. Some of the most pressing issues facing individual consumers and the larger mental health consumer movement as they encounter, experience, and respond to the implementation of managed behavioral health care include benefit design and service delivery, quality assurance and research, consumer rights and protections, and advocacy.

Self-help and peer-run services are critical components of the service mix that needs to be available to all consumers. It is important that the quality of these services be assessed by consumer-developed standards rather than traditional accreditation procedures.

Consumers must be integrally and authentically involved in the design, delivery, management, and evaluation of mental health services. The approach to services needs to be a holistic, recovery-based, consumer-focused approach, including informed choice as to whether or not to participate in services. Authors of this paper favor the passage

of federal and state laws that mandate consumer involvement. They want to assure that such involvement is written into public-sector managed care contracts and honored by providers.

***Family Issues in Managed Behavioral Health Care* - D. Noonan, et al.**

Family mental health advocates have made great strides toward highlighting the importance of families in the care of persons with mental illness. They currently play a key policy making role in some States. Yet challenges remain, particularly in light of recent changes in the way mental health, medical, and social services are delivered.

Meaningful, proactive involvement of families and consumers in all decision-making areas serves as the foundation for model advocacy, e.g., in legislation, practice guidelines, and contracts. To advance this involvement, families and consumers must collect, analyze, and disseminate data, develop programs for education and legislative advocacy, participate on advisory boards, and become involved in the development, oversight and monitoring of contracts.

Major issues with respect to managed care settings include limitations on availability of high-quality providers, access to services, and the quality and effectiveness of care. The need for comprehensive, coordinated care delivered according to recognized standards of quality is critical. Families stress the need for standards (with, perhaps, sanctions) requiring consumer and family member involvement in the development and monitoring of any contracts where public funds are expended.

***Integrating Services for Children in the Era of Managed Care* - S. Foster, et al.**

The recognition that care for children with mental health and other social, educational, and medical needs is seriously compromised by fragmentation has led to important efforts to coordinate services among agencies and to involve families in the entire process. Service integration has been a goal for decades, but new opportunities are available as the public and private sectors transition to managed care. The paper outlines the many issues that exist with respect to the integration of children's mental health services with education, health care, substance abuse treatment, and the juvenile justice system.

Recommendations for improving services for children and overcoming barriers to services integration include the following:

States need to work toward an interagency focus and agreements. Their contracts must purchase quality care based on specific positive outcomes, rather than being totally cost driven.

Federal agencies need to provide overall direction through legislation, dissemination of guidelines and educational materials around service integration, collaborative Federal activities, involvement of families in building systems of care, and increased coordination and cross-funding for technical assistance centers.

Research should evaluate programs that track children through the managed care system over time as well as study outcomes associated with blended funding and services.

Family and consumer involvement, including involvement by youth, should be integral to the activities of managed care companies.

Clinical care must be consistent with the values and principles of larger systems of care, irrespective of the organizational culture or the individual clinician within the system.

***Integration of Mental Health and Other Services for Adults* - S. Foster, et al.**

Little doubt exists that an integrated service system for persons with mental illness provides better care than a fragmented, duplicative service array. Such an integrated service system offers comprehensive psychosocial services in an individualized, flexible manner by a multi-disciplinary team of providers.

System reform toward more effectively integrated services needs to reflect and include consumers and be driven by outcome assessment. Ongoing positive relationships among all persons — consumers, families, agencies, and policymakers — are critical. Challenges to such efforts include the multiple agencies involved and their often competing interests and the lack of integrated information systems to support service integration. Given the scattered nature of available services, rural areas, in particular, face major service integration issues.

Financial incentives through service contract requirements are needed to promote and enhance integration across categorical agencies. Ultimately, it is the payers who will be instrumental in assuring that such integration occurs. We also need additional research that assesses the improved outcomes that result from integrated service systems, particularly longitudinal studies of systems.

***Partners or Antagonists: Medicaid and the State Mental Health Agency in the Era of Managed Care* -J. Michel, et al.**

Medicaid managed care initiatives are intended to control escalating costs, expand coverage and access to services, and improve quality of care. Behavioral health care has been the most prominent specialty service to command the attention of Medicaid directors across the nation. At the same time, MHAs have been completing a process of downsizing large public institutions, attempting to develop and consolidate community-based systems of care, and supporting a burgeoning consumer movement — all while coping with a rapidly changing business landscape.

Structural, procedural, and political aspects of the relationship between Medicaid and the public MHAs affect the design and implementation of managed care initiatives. Of particular interest are the factors that influence how Medicaid and MHAs work together, or at cross purposes, in setting public mental health policy and in approaching financial, administrative, and consumer issues. Examples of conflict areas include the definitions and use of the medical necessity criterion for service coverage, the structure of basic versus long term Medicaid benefits, and the use of traditional community provider organizations versus open competition.

Strategies to enhance interagency cooperation include development of structures and processes to support an ongoing interagency dialog; a collaborative and comprehensive review of all functional areas of both agencies to identify priority areas for systems improvement; identification of strengths, weaknesses, and areas of competence for each agency and methods for building on strengths; development of an interagency action plan to clarify roles, responsibilities, and relationships with key stakeholders; and development of meaningful, manageable measures of system-level performance.

Public Sector Purchasing of Managed Behavioral Health Care - C. Croze, et al.

As is true for all governmental functions, publicly sponsored mental health services are being transformed in an attempt to manage limited resources. Public MHAs are incorporating managed care strategies into their service delivery and entering into risk-sharing arrangements with private organizations. Public sector purchasing decisions have considerable impact on public systems of care. Before moving to change the public system or supporting the status quo, the MHA must complete a thoughtful risk assessment that includes defining the public interest and the government's role within this definition; examining the local and state support for privatization versus government programs; honestly evaluating current system functioning, with consumer input as a critical component of this evaluation; setting up purchasing specifications to address problems and identified strengths; assessing the potential impacts of system change; assessing the relationship among funding streams and setting up a coordinated plan for the use of public behavioral healthcare funding; strategically evaluating the risks accompanying action or inaction; assessing and addressing the skill level of the MHA to undertake systems change; and conducting an environmental scan of political forces.

Public MHAs do not always have the controlling role within systems change; there have been power struggles between the State Medicaid agency and the State MHA. It is critical for MHAs to be honest with stakeholders concerning areas they do control and those they do not. This allows stakeholders to seek and obtain entree with those in power and have the opportunity for meaningful input in all areas of system change.

Once the decision for system change has been made, a number of issues must be considered: the role of the purchaser/care manager; whether to use an internal or external agent for risk-based care management; statewide or regional/local design; role of the MHA as payer, purchaser, or provider; level of risk bearing/transfer; and linkage of profits to performance.

It is unclear where public sector managed behavioral health care activity will move in the future. It exists within a political and governmental environment in which State budgetary problems have receded somewhat from the recent past. We may see more regionalization, greater use of Administrative Services Only arrangements, and more integrated funding as States seek to maintain some level of control.

Issues Affecting Clinical Practice in an Era of Managed Behavioral Health Care - J. Winarski, et al.

The role of clinicians is changing. Managed care has had an enormous impact on the practices of "higher cost" providers, the length and locus of care, and standardization of practice. Clinicians accustomed to operating autonomously under a fee-for-service system are adapting to an array of new demands that affect practice, documentation, and the clinician-consumer relationship. In response, they are developing new skills: brief treatment, group work, care management, partnering with MCOs, negotiating for service and advocating for consumers. Training clinicians in these competencies is adversely affected by a lack of resources for such training, an educational system resistant to facing such market realities, and a lack of reimbursement for clinical training programs.

As clinicians adjust to managed care environments tension arises between provider views of managed care and the economic necessity of adapting to it. Ensuring that providers will have the special skills required to treat persons within the public sector and to preserve quality of care over profits requires participation by clinicians in system development and change. The need for quality care is universally agreed upon; however, measures of quality are not universally agreed upon nor available. Issues around quality management include the need for clinician involvement in developing outcome and best-practice data and for clinical guidelines that are accurate, reliable, and flexible. Clinicians are responsible for quality even without guidelines, and the issue of linking financial rewards to clinical outcomes is problematic. Credentialing programs need simplification and should include consumer and paraprofessional providers of services.

A number of ethical issues exist for providers, particularly with respect to maintaining privacy and confidentiality when sharing information with MCOs, payers, and case managers. A unique challenge exists in balancing cost savings with providing high-quality care.

Clinical Practice Guidelines - D. Noonan, et al.

The proliferation of clinical practice guidelines in recent years has produced a lively debate on their uses, merits, and risks. While guidelines are a valuable tool for managing complex clinical situations and for assessing the components of service delivery systems, a variety of issues affects their full acceptance by providers and consumers. Limitations with current guidelines include the proprietary nature of many guidelines, the lack of consumer input into guideline development, the tendency to produce overly-complicated guidelines that cannot be used in real practice, the lack of agreed-upon guidelines among multiple stakeholders, and the lack of guidelines that address many of the most important issues faced in the public sector — dual diagnoses, difficult-to-treat problems, and multiple treatment settings.

The issue of sanctions for failure to adhere to guidelines is highly controversial. Many view this as ill-advised, stressing the need for guidelines to inform rather than control

decision making. Educational programs should accompany guidelines, targeted at practicing providers and consumers and family members. Guidelines are useful components of quality improvement programs when linked to consumer outcomes, but linkage must be done carefully and collaboratively by researchers, consumers, family members, clinicians, and health care administrators.

To be valuable, guidelines need to be developed systematically and collaboratively. They must meet high standards of quality and be nonproprietary, brief, and easy to follow with supporting educational material. Guidelines should be applicable to both primary and specialty care settings, available to clinical trainees, updated regularly, and developed for high-risk conditions. In addition, a need exists for guidelines that address optimal quality of life for persons suffering from serious disorders, regardless of the cost. With such guidelines, decision-makers will have the tools to balance quality and cost concerns.

Measuring Outcomes for Mental Health Services - S. Minden, et al.

Determining the outcome of an individual's treatment is crucial to improving quality of care and enhancing the accountability of those who provide it. Examining outcomes for whole populations and communities shows how well entire systems are performing in regard to the quality of care they provide and where their performance needs improvement. The key issues in outcome measurement include attention to differences among stakeholder groups, appropriate use and interpretation of outcome data, standardization of outcome measurement, and technical considerations in designing the outcome measurement system.

The ideal outcome assessment system should meet the needs and interests of all constituencies. Involvement of all stakeholders in the development and implementation of the system will help promote culturally competent results. The system should include both generic and disease-specific measures and collect both quantitative and qualitative data.

Implementing outcome measurement systems in actual practice requires several carefully planned steps: building strong political commitment to use the system for both accountability and quality improvement applications; establishing a clear vision of system objectives and process; spending time in realistic planning; getting the commitment of providers, consumers, and staff who will work with the system; obtaining information about consumer and family member experiences directly from them; selecting outcome domains and indicators reflecting the needs of the users of the system; combining data from multiple sources; establishing clear procedures for collecting and analyzing data; ensuring that what is measured is what actually occurred; integrating outcome information with other measures of quality; and using outcome data to improve the quality of care.

Many projects are currently underway on outcome measurement at both the consumer and the system level. As a field, we need to systematically build upon past and current efforts, and standardize and integrate outcomes with other efforts. We need to include consumers at all levels of planning and implementation and collect and interpret information that adheres to scientific standards of quality.

Mental Health Report Cards - M. Friedman, et al.

Report cards are published collections of empirical measures that allow for the evaluation of specific aspects of MCOs and mental health service delivery systems and their management structures. They include, but are not limited to, assessments of clinical and service quality, access, consumer satisfaction, cost-effectiveness, and outcomes. While consensus exists on the value of report card data and the importance of public accountability of managed care organizations and provider networks, there is less agreement on what constitutes a “good” report card. Specific issues that affect mental health report card development efforts include standardization, confidentiality, interpretation of data, and consumer choice.

Several constituencies require report card data: consumers, MCOs, providers, and public and private purchasers of care. For each of these groups, different types of performance indicators are needed. Development of a core set of items that all constituencies are concerned with and additional items specific to each constituency may make it feasible to develop useful tools for all groups. An ongoing forum around report card issues involving all major constituencies will advance the state of the art.

Future Directions

The major areas of agreement among the focus groups and the policy papers that resulted from this project were on the need for the following:

- Participation by all major stakeholders, particularly consumers, in all areas that were addressed, including system reform, outcome measurement systems, clinical guidelines, State contracting, and report cards,
- Delivery of quality services and ways to measure them;
- Moving forward proactively to effect change.

Less than perfect agreement existed on several issues:

- Whose perspective should drive quality tools such as outcomes — consumers, clinicians, service administrators, or payers?
- How much flexibility is needed to reflect individual needs and choices?
- Exactly what should the role of government be with respect to legislation and sanctions?

It is clear from the issues raised in this project and from other ongoing activities that the mental health field desperately needs tools to measure the quality of care and that such measures should be consensually based with meaningful input from all major stakeholders. At present, financial supports for mental health care are declining dramatically in both the public and private sectors. Consensus does not exist on system and

clinical practice guidelines, outcome measures, and report cards that can assess and document mental health care quality. Without these quality measures, negotiation for resources is greatly hampered. In the absence of consensually based assessment systems, price has become the only measure of quality of care and the only focus of accountability.

Manderscheid (1998) outlines the following critical steps that should be taken in the quality process once overall goals are set:

- Discussions about values
- Evolution of principles for action
- Development of guidelines for interventions
 - System guidelines
 - Clinical guidelines
 - Ethical guidelines
- Performance measurements
 - Outcomes
 - Report Cards
- Feedback processing

A crucial step in support of this process is building consensus around and testing a model for the comprehensive data system to assess quality of care. Such a system could be built on the public health model as outlined in Manderscheid and Henderson (1996). It would allow for assessment of performance at the population level through health status measures; at the system intervention level through system- and clinical-level practice guidelines and enrollment, encounter, and cost data; and at the person-intervention level through clinical outcome measures. To continually improve assessment, information would be fed back into the system through the use of report cards and performance indicator systems. All of these components must be linked into an integrated data system. Clearly, to make progress in this area, input and cooperation are essential for all the major stakeholders in the field.

In response to this need, CMHS has initiated a two-year follow-on project that will help speed up the development of the comprehensive integrated data system just described. The project has several major parts. Because the whole area of broadly based system and clinical practice guidelines within the behavioral health care field is poorly developed, the first part of the project will obtain information on the status of guidelines through a literature review and focus groups. Information learned will be incorporated into the later tasks of convening a technical workgroup that will set up the model data system and conducting case studies at natural sites to look at adherence to the model or components of the model in actual practice. Policy analyses will be prepared that present

our current understanding of how to measure system and clinical guidelines and how they fit into the overall data model that evolved from the project. Lessons learned from this project will feed back into ongoing CMHS developmental activities, including the current MHSIP efforts to develop a framework for a new set of data standards for mental health (MHSIP Ad Hoc Group, 1997).

CMHS is also continuing to move forward with other projects that will advance the development and implementation of quality tools. In the area of outcomes, workgroups on content and methodological standards for both adults and children are ongoing. Drafts of principles and standards have been prepared (Adult Outcome Measurement Standards Committee, 1997; CMHS Outcomes Roundtable, 1997; Smith et al., 1997) and will be fed into the comprehensive data model.

The area of report cards has witnessed considerable progress, including the MHSIP Consumer-Oriented Report Card (MHSIP, 1996) which is being tested within State grants; support to the American College of Mental Health Administrators to develop a core data set for report cards; and initiation of a project to bring major report card developers together to develop a pilot study of the common core set of items required for a population-based report card.

In the area of performance indicators, CMHS awarded grant supplements to five States (Colorado, Illinois, Massachusetts, South Carolina, and Texas) to complete a feasibility study that has resulted in a set of core indicators for performance (NASMHPD-RI, 1998) that will then be piloted by a larger number of States through additional grants.

Multiple projects are ongoing in the field to develop specific data items and processes within the quality arena. We hope to draw upon and build upon this past and ongoing work. It is critical that the various pieces be linked together into an integrated framework that includes the range of types of data needed so that we can begin to see quality improvement throughout our system.

To make major strides in this area, ultimately, we need to increase our focus considerably and put forth major initiatives centered around the development, testing, and implementation of quality tools. This represents a major challenge to the behavioral health care field at present. Rapid progress is critical if the field is to compete in this era of accountability.

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Consumer Issues in Managed Behavioral Health Care

Mary Auslander, Dawn Jahn Moses, David Granger,
Marilyn J. Henderson, Johnette Johnson, J. Rock Johnson,
Edward Knight, Kathy Lynch, Ronald W. Manderscheid,
Garret Smith, Laura Van Tosh

Introduction and Background

Pressing issues face mental health consumers and the larger mental health consumer movement as they encounter and respond to the implementation of managed behavioral health care. Toward that end, this paper reports on adult consumers' experiences with, concerns about, and suggestions for improvement on, a variety of public managed behavioral health care issues.¹ Issues facing children and family members are addressed in separate papers in this volume.

It is important to note that the consumer movement includes a broad diversity of views and opinions. We have done our best to capture the thoughts and concerns of many of those involved. The specific issues discussed in this paper include:

- consumer involvement in the design, delivery, and evaluation of mental health services;
- care and treatment philosophies;
- benefit design and service delivery;
- quality assurance and research;
- consumer rights and protections; and
- systems advocacy.

Responding to inadequacies in the mental health service system and concerns over mistreatment and injustices within the system, the contemporary mental health consumer movement began to take shape in the early 1970s. Over time, this grass-roots effort developed into a coherent and powerful movement that has been effective in making mental health service systems more responsive to the needs and desires of the people they serve.

¹ Given that most of the efforts of the mental health consumer movement have been directed toward public systems of care, this paper will focus, in large part, on the implementation of managed behavioral health care within public mental health systems.

Finally, those who were considered unable to speak for themselves demanded that they be heard — they pushed to be treated in a humane manner, to be given treatment choices, and to be included as active participants in the design and delivery of mental health services (Chamberlin, 1990, 1984; Zinman et al., 1987; Smith and Ford, 1986).

The mental health consumer movement has significantly influenced the public mental health service delivery system over the past three decades. Some of the most profound changes that have occurred as a result include:

- enacting Federal and state laws mandating consumer participation in state and local mental health planning activities;
- recognizing consumers' rights and establishing systematic procedures to protect these rights;
- acknowledging the value of consumers as providers of services and developing and funding an array of consumer-run and other alternative services;
- establishing offices of consumer affairs within many public mental health authorities;
- creating positions for consumers on boards and committees that guide mental health organizations;
- increasing awareness of the demonstrated value and importance of involving consumers at the individual, program, and systems level; and
- educating the public about the experiences of mental illness, its treatment, and the effects of stigma.

The emergence of managed behavioral health care within public mental health systems has presented opportunities and challenges for mental health consumers and the broader consumer movement. The current reconfiguration of mental health systems, with its focus on effective, cost-efficient service interventions may provide greater opportunities for the development of consumer-run and other alternative services. Managed care's emphasis on outcomes and quality assurance may also provide consumers with more effective vehicles for voicing their opinions about the usefulness and quality of the services they receive.

The implementation of public managed behavioral health care and the trend toward contracting with private for-profit and not-for-profit organizations to manage publicly-funded services also raises concerns for many mental health consumers. Consumers face, once again, having to justify and ensure their central involvement in all aspects of the mental health service system. It is not clear whether the values of inclusion, recovery, empowerment, and self-determination, which are critically important to consumers and have been adopted by good public mental health systems, will be incorporated into the contracts creating these new, "business-oriented" systems of care. The emphasis many

states are placing on cost-cutting raises concerns about access to care, the quality of care, and the existence and effectiveness of client protection and grievance procedures. Consumers must also learn how to navigate new delivery systems with new rules and new players. Finally, it is important to note that these changes are occurring at the same time as key public programs that provide critically important financial support for people with disabilities (Supplemental Security Income - SSI, Social Security Disability Insurance - SSDI, Aid to Families with Dependent Children - AFDC) are being radically altered as well.

Consumer Involvement In the Design, Delivery, and Evaluation of Mental Health Services

Active involvement in the design, delivery, and evaluation of mental health services is a central tenet of the mental health consumer movement (Fisher, 1994; Van Tosh, 1993; Chamberlin, 1978). On the individual level, consumers want to have control over determining what services they need, and how and where they will receive these services. On the program and systems levels, consumers want to actively participate in planning, delivering, and assessing the effectiveness of programs and the larger mental health system. Many consumers want recipients of services to be the sole determiners of these issues, while others prefer to be placed on equal footing with policy makers, program officials, and providers. Involvement is seen as critically important in generating needed knowledge for effective program design and improvement. It is especially valuable regarding issues of respecting individual rights, designing services that are responsive to consumers' needs, empowering individuals, and supporting recovery.

Over the past three decades, consumers have worked to ensure their involvement in public mental health services and systems (Chamberlin, 1990, 1984; Smith and Ford, 1986, Stroul, 1986). This participation has been facilitated by laws requiring consumer involvement, growing acceptance of consumer-run services as critical components of any mental health system, and increased awareness of the importance of involving consumers in their own rehabilitation and recovery. Although not always sufficient, most public mental health systems have developed mechanisms to ensure at least some level of consumer involvement. For example, state mental health systems are required to involve consumers in state mental health planning efforts (Public Law 102-321, formerly P.L. 99-660) and in the development and ongoing advisement of Protection and Advocacy agencies to investigate patient rights abuses (P.L. 99-319) (Van Tosh, 1993). Local planning and oversight boards now often involve consumers as well.

In general, private managed behavioral health care organizations do not have a history of working directly with mental health consumers in these ways (Judge David L. Bazelon Center for Mental Health Law, 1996, 1995). Many are accustomed to involving and reporting to the payers of services (e.g., employers) and company stock holders, but not

recipients of services. Again, consumers express concerns about whether the gains they have made in this area will be diminished or lost as public mental health systems transition to managed care. Given that recipient involvement is historically not a central part of this business culture, public mental health systems must preserve the few mechanisms currently in place to facilitate such interaction.

In order to ensure active consumer participation in public managed behavioral health care services, it is essential to involve consumers in all aspects of the new systems of care including:

- developing and reviewing public contracts including input on benefit design, outcome measures, clinical protocols, rate setting, and grievance procedures;
- selecting the managed behavioral health care organizations who receive public contracts;
- providing testimony at public hearings and facilitating consumer focus groups on mental health needs and services;
- serving on company and provider agency boards and committees with decision-making powers;
- participating in the training of providers contracted by managed behavioral health care organizations;
- delivering self-help and other consumer-run services;
- developing, implementing, and monitoring quality assurance/improvement activities;
- providing consumer education and advocacy services;
- developing, implementing, and monitoring appeal and grievance procedures;
- designing and implementing research projects on processes and outcomes relevant to treatment, choice, and recovery; and
- serving in management positions in public mental health agencies and managed care organizations.

Consumer involvement must be protected through Federal and state laws and specifically included in contractual arrangements between states and managed behavioral health care companies. It is imperative that consumer participation be authentic. For example, consumers should not be asked to approve policy after it has been developed, but should be centrally involved in all aspects of its development. Consumer participation also must be representative of the population to be addressed (e.g., people of color and young and elderly adults). Finally, it is important to recognize that consumers serving in these roles are working as professionals with unique expertise as a result of their experiences and it is essential to appropriately compensate them for the services they provide.

Care and Treatment Philosophies

Over the past 25 years, consumers have worked to expand and redefine the mental health community's understanding of mental illness and stigma (Blanch et al., 1993; Estroff et al., 1991; Chamberlin, 1984). First, many consumers believe that there are multiple factors, not just biology, that contribute to what is considered mental illness. Biology may be a factor (and many consumers would agree on its importance), yet it is only one of many that lead to diagnosis and treatment in the mental health system. For example, histories of trauma and sexual and physical abuse have recently been documented to be significant factors in developing symptoms that appear to be mental illness (Muenzenmaier et al., 1993; Herman, 1992; Rose et al., 1991). Consumers believe it is necessary to see individuals holistically and as being influenced psychologically, socially, spiritually, and biologically. Care and treatment philosophies that consider only one aspect of a person, without thought to its interaction with others, is found by consumers to be incomplete, devaluing, and often damaging.

In addition, many consumers and some professionals embrace the view that recovery from psychiatric diagnoses is possible (Anthony, 1993; Deegan, 1988). Recovery is based on the goal and reality that people heal and go on to lead full lives integrated in their communities. Recovery is consumer-defined, consumer-centered, and consumer-driven. The belief that people can recover creates care and treatment that looks quite different from what is designed for people who are expected to remain ill.

Most mental health systems, including managed behavioral health care service delivery models, are still based on medical, illness-based approaches to diagnosis and treatment. These models are provider-centered and driven and heavily emphasize diagnosis, symptom reduction and management through medication, treatment compliance, and standardization. Many consumers find these approaches to be limited, deficit-focused, paternalistic, and controlling (Chamberlin, 1995).

It is important for managed behavioral health care organizations to embrace a holistic, recovery-based, and consumer-focused approach to mental health services. To do so would profoundly alter the management and delivery of services. Specifically:

- service delivery systems would be based on the knowledge and expertise of consumers;
- consumers would be the primary determiners of their own care and services would be individualized to meet the stated needs and desires of each consumer through the development of personal treatment plans;
- benefit packages and definitions of medical necessity would include a broad array of non-medical, support services such as education and career counseling, permanent housing, and transportation;

- services would be provided in ways that foster recovery and focus on strengths and autonomy by expanding consumer choice, promoting wellness, and eliminating coercion;
- services would be assessed for their effectiveness in producing recovery-oriented, positive, consumer-defined outcomes;
- increased collaboration would occur among mental health, social service, housing, education, legal, and other systems; and
- reinvestment strategies would ensure the development of community-based services that are run by and for consumers.

Benefit Design and Service Delivery

Following from care and treatment philosophies centered around recovery, it is imperative that the benefit packages being designed under managed behavioral health care initiatives promote wellness, empowerment, and person-centered care. Consumer involvement in developing mental health benefit packages is imperative. Services identified by consumers as essential include: self-help, mutual support, and other services that are designed to empower individuals; rehabilitation services; outreach and crisis services; counseling services; medical services; and adjunctive services such as housing and transportation (Penney, 1997). In addition, many consumers have found holistic and alternative interventions (e.g., acupuncture, nutritional regimens, body work) to be extremely helpful.

Benefit packages must be flexible and not force consumers into a standardized service progression or pace. For example, some individuals might prefer and benefit from services provided on an intermittent basis, as opposed to successively; other individuals might wish to participate in a combination of individual and group sessions as opposed to only group therapy. Consumers should be educated about their benefits, rights, and appeal and grievance processes. Most consumers believe that no limits should be placed on the amount of services available, and at a minimum, coverage should be sufficient to meet the long-term needs of consumers.

Although critically important, having a mandated comprehensive benefit package is not sufficient to ensure access to quality services that meet individual needs. In addition to a comprehensive benefit package:

- consumers must be able to choose whether to receive services at all and what services to receive;
- services must be individualized;
- criteria used to determine the provision of services must be broad enough to meet a range of treatment and support needs;

- services must be offered in a variety of settings by a variety of providers;
- services must be readily available (no waiting lists) and accessible (physically convenient, language appropriate, and provided in ways that are sensitive to age, gender, ethnicity, and culture); and
- spending limits must support the appropriate provision of services.

For many consumers, self-help and peer-run services are the cornerstone of their recovery and empowerment (Felton et al., 1995; Chamberlin, 1978). Concern exists that these types of alternative services may not “survive” the transition to public managed behavioral health care. These non-traditional programs may be at risk because they have not always been included in private or publicly funded mental health benefit packages and because they often do not have formal management structures and in-depth administrative capacity.

It is essential that self-help and peer-run services be included in managed behavioral health care packages and that they be promoted by both management and traditional providers. Requirements placed on professionally licensed providers (e.g., state certification examinations) must not be applied to these alternative programs. Instead, consumer-developed standards to assess the quality and competence of peer-run services can be implemented. Peer-run services must be reimbursed at competitive rates to allow for their continued existence.

It is important to ensure that peer-run services included in managed behavioral health care arrangements are truly peer-run. In an effort to promote consumer-run programs, some states have created incentives for their involvement in the new systems of care. Anecdotal information suggests that some programs have portrayed themselves as peer-run when they are not, in order to gain entrance into the system. For example, a program that is fully staffed by consumers, but where major decisions still rest with a professional board, is not truly peer-run.

Quality Assurance and Research

With substantial changes taking place in the management and design of public mental health services and the new emphasis being placed on cost containment and reduction, consumers are concerned about the quality of the care that will be available to them under new managed behavioral health care arrangements. In order to safeguard and protect consumers, it is critically important to have public contracts require that procedures be in place that accurately evaluate, from the consumers' perspective, the quality, appropriateness, and effectiveness of services being provided.

Many managed behavioral health care organizations possess experience in the areas of quality assurance and outcome measurement. The field also has a track record of investing resources in sophisticated cost and care monitoring technologies. However,

these technologies have not been used in public mental health systems with individuals who have long-term or intensive mental health needs, nor have they been developed with consumer input. Consumers worry that managed behavioral health care systems will utilize definitions of quality that are not responsive to their needs and values, and measures and assessment procedures that do not accurately assess their experiences (Campbell, 1997).

In order to ensure that high quality managed behavioral health services are available, public mental health systems and managed behavioral health care contractors must:

- actively involve consumers (from the state contracting process through implementation and evaluation) in the definition of quality and in the design of all quality assurance activities, the collection and assessment of all relevant data, and all monitoring efforts;
- establish internal (overseen by the managed behavioral health care organization) and external (overseen by the public mental health authority and outside consumer "watch-dog" organizations) quality assurance procedures that are confidential and easily accessible to clients;
- utilize quality assurance efforts that go beyond measuring the structure and process of care and focus on client outcomes (Mental Health Statistics Improvement Program Task Force on a Consumer-Oriented Mental Health Report Card, 1996);
- develop outcomes and outcome measures that are consumer-defined and accurately capture consumers' needs and priorities (Campbell, 1996);
- ensure that information from all quality assurance activities is readily available and accessible to consumers; and
- guarantee privacy and confidentiality of all individual data collected.

While issues of privacy and confidentiality are of concern to consumers in all types of managed care arrangements, for individuals receiving mental health care services it is of the utmost importance. This is due, in part, to the pervasive stigma and discrimination against people who have received mental health services. While it is recognized that data must be collected for quality assurance purposes, it is imperative that individual level data be kept confidential.

Finally, Federal, state, and local mental health systems and managed behavioral health care organizations must initiate research projects to determine the impact of managed behavioral health care on the recipients of services. It is important to learn about consumers' experiences with access to and the quality of public managed behavioral health care services and the outcomes associated with these services. Consumers must be involved in formulating the questions and issues to be considered, creating study designs, conducting research, and analyzing and interpreting findings. This involvement will insure the relevance and usefulness of research findings (Campbell, 1993). In fact,

excellent examples of research conducted solely by consumers and in collaboration with other researchers exist and have begun to appear in mainstream literature (Campbell, 1997, 1996; Carpinello et al., 1992).

Consumer Rights and Protections

Historically, individuals diagnosed with mental illness have not been afforded the same rights and protections as those seeking and receiving other kinds of health care services (Sundram, 1995; Chamberlin, 1990). This is due, in large part, to a once commonly held belief that individuals with mental illness could not think clearly and make decisions for themselves. These beliefs resulted in the creation of service interventions that often ignored the wishes of the consumers of services and the establishment of laws that allow state and local authorities to involuntarily commit and treat individuals with mental illness against their will (Appelbaum, 1996).

Consumers have fought hard to enact laws and regulations that require states, localities, and individual providers to observe and protect consumers' basic human rights and to implement mechanisms to ensure that these protections are provided. Much of the work that has been done in this area has focused on protecting the basic civil and human rights of individuals in inpatient settings. Attempts are currently being made to expand these protections to include individuals with psychiatric labels residing in the community. In some states, consumers have taken this one step further and developed mental health consumer "bills of rights" that outline an even broader set of individual rights including rights to both utilize and refuse services, to choose providers and care settings, and to receive services in a confidential manner (Consumer Managed Care Network, 1996; Judge David L. Bazelon Center for Mental Health Law, 1996, 1995).

Consumers are wary that implementing managed care in public mental health systems and the corresponding reduction in the traditional roles of public mental health authorities may result in situations where consumers' rights are violated and that individuals will not be afforded proper protections or mechanisms for recourse (Fleischner, 1994). It is important that consumers' rights be outlined and protected in Federal and state law and in managed behavioral health care contracts. In addition, appeal and grievance, mediation, and arbitration procedures must be in place to provide consumers with appropriate and safe options for recourse when they feel their rights have been violated. It is critically important to:

- establish and publish understandable and accessible appeal and grievance procedures;
- ensure that consumers are not retaliated against (e.g., disenrolled, denied referrals) for exercising their rights (e.g., refusing treatment) or filing a complaint against a provider or a managed care organization;

- provide internal advocates/ombudsmen who can help consumers through appeal and grievance procedures;
- provide external advocates who are not funded by or tied to managed behavioral health care organizations who can help consumers advocate for their rights;
- facilitate access to outside mediation services;
- educate consumers on their rights and the appeal and grievance processes using a variety of mechanisms (e.g., written materials, video tapes, role playing, peer advocates)
- empower consumers to advocate for themselves and to utilize the protections that are in place when necessary; and
- continue necessary services while disputes are being resolved.

Above all, consumers should be full participants in all these activities.

Systems Advocacy

As stated previously, the advent of public managed behavioral health care presents significant challenges to the mental health consumer advocacy movement. Consumers must establish new contacts, fortify previous gains, and advocate for change in a new, for-profit, business-oriented culture that has little experience working directly with the primary consumers of their services. Public contractors and managed care organizations have a responsibility to become educated about the consumer movement, self-help and consumer-operated services, and the philosophical underpinnings of recovery. This work must be done quickly as systems of care are rapidly transforming (Rodwin, 1996).

Consumers insist that they must continue to speak and advocate for themselves and many feel the movement would benefit from a single national consumer advocacy organization. In order to advocate effectively, consumers assert that they must have: access to information; the ability to provide information to managed care plan enrollees; freedom to monitor these new systems; and open channels to communicate with managed behavioral health care leaders.

Many in the movement also believe that managed care presents an opportunity for increased collaboration with other groups concerned with the availability of accessible, high quality health and mental health care services. On issues of mutual concern, collaboration with family members, providers, health consumers, and broader consumer protection advocates could help effect meaningful change. These collaborations must be done, however, with great thought in order to maintain the integrity of the movement and protect it against exploitation.

Conclusion

Implementing managed care technologies within public mental health systems is profoundly changing the way services are organized, delivered, and financed in the United States. These changes present both great opportunities and risks for mental health consumers and the larger mental health consumer movement. To ensure that the service system is responsive to its clients, it is imperative that mental health consumers be involved in system redesign efforts and in all aspects of the new managed care systems. This involvement must be mandated by Federal and state laws, included in all public-sector contracts, and respectfully honored by managed behavioral health care organizations and providers. Involving consumers in meaningful ways will result in effective, cost-efficient services that are sensitive to the needs of the individuals they are intended to help.

Information Resources

For more information on consumer issues in managed behavioral health care, you may wish to contact some of the organizations listed below.

The Center for Mental Health Services (CMHS)

Knowledge Exchange Network (KEN)

P.O. Box 42490

Washington, DC 20015

800-789-2647 (voice)

301-443-9006 (TDD)

800-790-2647 (Bulletin Board)

<http://www.mentalhealth.org>

American Managed Behavioral Healthcare Association (AMBHA)

700 13th Street, NW, Suite 950

Washington, DC 20005

202-434-4565

<http://www.ambha.org>

Judge David L. Bazelon Center for Mental Health Law

1101 15th Street, NW, Suite 1212

Washington, DC 20005-5002

202-467-5730 (voice)

202-467-4232 (TDD)

<http://www.bazelon.org>

National Alliance for the Mentally Ill (NAMI)

200 North Glebe Road, Suite 1015

Arlington, VA 22203-3754

703-524-7600 (voice)

703-516-7991 (TDD)

800-950-NAMI (Helpline)

<http://www.nami.org>

National Association of Consumer/Survivor Mental Health Administrators

c/o Darby Penney

Director of the Bureau of Recipient Affairs

New York State Office of Mental Health

44 Holland Avenue

Albany, NY 12229

518-473-6579

National Empowerment Center

20 Ballard Road

Lawrence, MA 01843

1-800-Power-2-U

National Mental Health Association (NMHA)

1021 Prince Street

Alexandria, VA 22314-2971

703-684-7722

800-969-NMHA (Mental Health Information Center)

<http://www.nmha.org>

National Mental Health Consumers' Self-Help Clearinghouse

1211 Chestnut Street, Suite 1000

Philadelphia, PA 19107

800-553-4KEY

http://www.libertynet.org/~mha/cl_house.html

National Technical Assistance Council for State Mental Health Planning (NASMHPD)

National Association of State Mental Health Program Directors

66 Canal Center Plaza, Suite 302

Alexandria, VA 22314

703-739-9333

<http://www.nasmhpd.org/ntac>

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Family Issues in Managed Behavioral Health Care

**Denise Noonan, Sarah Minden, Dawn Anderson, Curtis Flory,
Joyce Friedman, June Gross, Laura Lee Hall, Marilyn J. Henderson,
Ronald W. Manderscheid, Felicita Nieves, Eleanor Owen**

Introduction and Background

Increasingly, people with serious mental illnesses receive services in managed behavioral health care settings, whether in the private or public sector. Managed care holds out the promise of better coordination of services, more accountability, and cost savings. There is, however, great concern that inadequate or inappropriate care may result from cost cutting measures such as restricting access to services or employing less qualified providers to deliver care. Families of consumers have been in the forefront of efforts to hold mental health providers accountable for quality care. This paper summarizes many of the concerns families express about the mental health care system in our country today and describes the advocacy efforts that have arisen from these concerns.

It was not so long ago that families of adults with serious mental illness and children with serious emotional disturbance were widely perceived as having caused the disorder. This was particularly true for schizophrenia. Some theorists (Bateson, et al., 1956; Lidz, 1973; Wynne and Singer, 1977) observed dysfunctional communication patterns among people with schizophrenia and concluded that these patterns were learned within the family. Families were faced not only with the anguish and stress of a loved one's illness, but the added burden of being held responsible for it by professionals.

There has been some shift in attitudes about families with mental illness due to biogenetic research, improved understanding of the emotional and behavioral impact of a chronic stress such as mental illness, and the effects of the deinstitutionalization movement. The biogenetic roots of mental illness are better understood, as is the role of social environment in triggering or discouraging relapse (Goldstein and Doane, 1982).

In recent years, families have more fully participated as partners in the recovery of a person with mental illness. This trend began with deinstitutionalization and the return of many people to their communities. It has continued with improvements in medications to treat serious mental illness and with the changes in mental health services brought about by managed care. As hospital stays have shortened, mental health care providers have increasingly turned to families as sources of shelter, support, and advocacy for their family member. (Lefly, 1989)

Families find themselves on the front lines of advocating for their loved ones' best interests with health care providers, police, judges, and employers. At times they may have to take positions that are opposed by their relative, such as supporting involuntary commitment in an effort to ensure safety. Too often, families must face these challenges without advice or help from professionals.

While many families are eager to be included in the care of their loved ones, they are also fully aware of the burdens this participation entails. There may be additional demands on time, interference with family routines, and disruption of relationships with other family members and friends. Financial strain can be severe since many families care for their family member with little or no support from the public system. Regardless of health care insurance coverage, families incur many unreimbursable expenses. The requirements of caregiving leave many family members fatigued, stressed, and sometimes feeling helpless and overwhelmed (Lefly, 1989).

It can be extremely difficult for families to reach out for help despite their clear need. The stigma of mental illness and serious emotional disturbance deters many from disclosing their problems to extended family, friends, or professionals. Men may have a particularly difficult time accepting mental illness in their family member and receiving support. Families can become quite isolated.

Unfortunately, while health care providers may look more to the family for assistance, they often do not provide the supports families need to succeed as caregivers. Information about the illness, inclusion in treatment planning, and access to resources such as respite care and financial planning are invaluable to families. The family advocacy movement has arisen in response to such needs and has emerged as a powerful force for change. Through advocacy organizations families become better informed and more able to promote their interests.

Strategies for Family Advocacy

Family advocacy usually begins on a very personal level: trying to ensure that a loved one gets the help he or she needs. For some advocates, these efforts eventually extend beyond their family member to helping others at the community, state or national level. But no matter how far-reaching their efforts, family advocates share a vision of "a comprehensive, integrated system of health care for mental illness that respects the rights and dignity of consumers and their families" (Laura Lee Hall, Deputy Director, NAMI, personal communication).

Family advocates have begun to articulate a model for advocacy that will promote the changes necessary to achieve this comprehensive, integrated system of care. The foundation of the model is meaningful involvement of families and consumers wherever and whenever decisions are being made that affect their well being. This means inclusion in advisory boards in health care organizations, schools, and state and local mental

health authorities. It means involvement in writing clinical practice guidelines that will shape the treatment plans of consumers. It means working hand-in-hand with legislators to write and promote legislation to ensure that consumers' rights are protected and their needs are met. Family advocates do not want merely to react to decisions, policies or legislation that have been finalized. Rather, they want to be in a proactive position in which their knowledge and expertise can shape the matter at hand.

The personal story is one of the most powerful tools family advocates have for advancing their message. Advocates find that when the public, administrators, and legislators can hear firsthand about the challenges, failures, and successes of consumers and families, they are more likely to respond. It is especially important that successful policies and programs be held up as models so that there is a clear message that positive outcomes can be had with collaboration, creativity, and proper allocation of resources.

Family advocates recognize both the power of the individual voice telling his or her story and the power of the collective voice in promoting its ideals. The collective voice can be even stronger if consumer and family advocacy groups collaborate with others who have similar goals. Groups committed to quality health care for all, advocates for people who are developmentally and physically disabled, homeless, or incarcerated and groups interested in preventing and treating substance abuse all offer possibilities for collaboration.

Key Tasks for Family Advocates

Family advocates identify five key tasks as vital to the advancement of their cause: data collection, education, legislative advocacy, participation on advisory boards, and involvement in the development, oversight, and monitoring of contracts. These activities have become increasingly important as the public systems have moved to managed mental health care.

Data Collection. Good data are essential for good advocacy because they contribute to more informed discussions and better decisions. Possession of compelling data enhances power at the bargaining table. Advocates need information on who is being served, where, and how. The "where" should include jails, prisons, homeless shelters, and detoxification facilities where mental illnesses affect a substantial percentage of the population.

Information on processes, outcomes, quality and costs of care is also critical. Outcomes of care include information on suicide rates, employment, incarceration, housing, and quality of life as well as standard clinical measures. Collection of this type of information will require comprehensive, integrated information systems in the private and public sectors. It is essential that such data are nonproprietary so that advocacy groups can have access to it. There must also be stringent guarantees of confidentiality for any information that could identify a particular individual.

Family advocates also want information about the difficulty consumers and families face in acquiring quality services so that problems can be identified and addressed. Consumer-oriented report cards offer families and consumers the opportunity to make informed choices among managed behavioral health plans and providers.

Education. A broad public education effort is essential to widespread support of the goals of family advocacy. Not only do citizens need to understand serious mental illness and its implications, they need to see that it is in everyone's interest to have the best, most cost-effective health care.

More narrowly focussed educational initiatives are important as well. Consumers and families need information to help them navigate the increasingly complex and managed systems of care. Legislators need to be informed about research demonstrating that mental illnesses are treatable disorders. They also need documentation of the cost effectiveness of various treatment approaches.

Legislative advocacy. Legislation that is in the best interests of people with serious mental illness and their families should be proposed and actively promoted. Advocacy groups around the country are working on issues such as parity coverage in private insurance for mental health treatment, standards for involuntary treatment, and inclusion of the new antipsychotics in formularies. Comprehensive, reliable data and compelling personal stories are both important elements of effective communication with legislators.

Participation on advisory boards. Family advocates seek meaningful participation on advisory boards of managed care organizations and state and local mental health authorities. They want to be involved in the process of identifying needs, designing programs, and remedying deficiencies.

Involvement in development, oversight, and monitoring of contracts. Family advocates are interested in meaningful involvement in activities related to contracts between purchasers of mental health services such as Federal, state, and local governments and private managed care organizations. Opportunities for participating in the development of RFPs (requests for proposals) and contracts are especially important so that family and consumer priorities are represented. Oversight and monitoring are also important, although public purchasers must ultimately be held accountable for these activities. Family advocates insist that contract language be precise in identifying specific goals to be met within specific time frames and that these goals be linked to outcome measures. Specificity of financial, clinical and system outcomes is critical.

Barriers to Family Advocacy

Effective family advocacy requires accurate information, a clear sense of purpose, excellent communication skills and, of course, time, energy and dollars. A number of barriers can make this work especially challenging. These include competing demands on time, insufficient skills for complex tasks, insufficient financial resources, language barriers, cultural barriers, and lack of interest.

Competing demands on time. Family advocates often devote considerable time to the care of a family member with serious mental illness. This is especially true for families whose child is affected and who must coordinate medical care, mental health services, and educational programming. The emotional, financial and physical strains experienced by family members may make it difficult for them to contribute to advocacy efforts that go beyond their family's boundaries.

Insufficient skills for complex tasks. Reading technical reports, collecting and analyzing data, drafting and promoting legislation, actively participating on advisory boards, monitoring adherence to contracts and the like require sophisticated knowledge and skills. While family advocacy groups may not perform all of these tasks themselves, they must determine who is responsible for them and be able to assess the competence of their performance. Advocates recommend that managed behavioral health care organizations and public mental health authorities offer training to consumers and family members to enhance their effectiveness on boards. Training would include issues such as understanding technical language, analyzing data, and reviewing contracts.

Insufficient financial resources. Much of the work of family advocates is uncompensated. There can be additional hardship for advocates whose children have serious emotional disturbances and who must pay for child care when they are attending meetings. In recognition of this barrier to involvement, a number of states have begun to compensate families and consumers for their participation on advisory panels. Advocates suggest that a percentage of the budgets of public mental health authorities and private managed behavioral health care organizations be set aside for such purposes.

Language and cultural barriers. Information that families need for effective advocacy is sometimes unavailable in their native language. Family advocates who work in school settings complain that language and cultural barriers can make it difficult to access appropriate services for children. Proposals, contracts, guidelines, program descriptions and the like must be made accessible to all interested parties.

Advocates point out that bureaucratic culture can also create a barrier to the involvement of families and consumers. Bureaucracies such as managed care organizations or public mental health agencies have their own cultures that can seem closed and intimidating. It is strategically important to know how to operate effectively in these settings.

Lack of interest. Family advocates would like to see more families become actively involved in advocacy efforts. They are concerned about some apparent disinterest, but also acknowledge that other factors such as a sense of powerlessness or social stigma may discourage participation. Family advocates emphasize the importance of presenting information to families in ways that are not only easily understood, but also inspirational. The certainty that active engagement will lead to better lives for consumers and families can provide that inspiration.

Family Advocacy in the Era of Managed Care

Over the years, family advocates have taken on scores of issues relating to the well-being of adults and children with mental illness. Health care, housing, education, rehabilitation services, and employment are just a few of the concerns that family members have addressed. Perhaps one of the most galvanizing issues of the past decade has been the impact of managed care on adults with serious and persistent mental illness and children with serious emotional disturbance. This is a phenomenon that reaches beyond community and state borders and has therefore stimulated new conversations and new alliances in the hopes of assuring quality care.

While many deficiencies in the mental health care system predate managed care, some have clearly been exacerbated. Family advocates observe that in the public sector, downsizing of state mental hospitals and shortening of hospital stays have not been balanced sufficiently with increases in community-based care. Crisis beds, assertive community treatment programs, housing services, psychosocial rehabilitation, and employment services are essential to reaching and maintaining stability within the community. Even when services such as these are available, they may be poorly integrated with mental health and medical care. This is especially true for people with combined mental health and substance abuse problems.

Key Issues for Families in Managed Care Settings

Families of consumers who have been treated in managed care settings identify a number of limitations, which they associate with risk to the well-being of their family member. The most prominent of these are concerns about providers, access to services, and quality and effectiveness of care.

Provider issues. Managed care providers often do not have sufficient training and experience in treating serious illness. Consumers and family members are rarely offered choice in either the type of provider or the specific provider they will see. Moreover, when a change of provider is necessary, the transition to a new provider may be chaotic.

Access to services. Gatekeepers in managed care organizations are often not educated in or familiar enough with serious mental illness to make appropriate referrals. Criteria for "medical necessity" lack clarity and are not uniformly applied. As a result, services that families think are necessary may be denied, and services are often not made available until there is a crisis. Finally, costs are shifted to consumers and families who can often ill afford them.

Quality and effectiveness of care. Many factors interfere with high quality, effective care: discharge from hospital may be premature and planning for post-hospital treatment inadequate; coordination among components of care such as housing, clinics, and day programs is generally lacking; formularies are restrictive, the newest medications

are not available, and decisions about medication are inappropriately driven by cost. Managed care companies have not yet developed services to replace the programs closed by public mental health authorities. In all of this, the process of appealing denials of services or making complaints is cumbersome and intimidating.

Families raise additional concerns specific to the care of children and adolescents in managed care organizations. They believe there has been widespread degradation of the quality of care at all levels. The goal of care seems to be stabilization rather than treatment for optimum functioning. Among the primary concerns of families with children and adolescents are the quality of providers, the involvement of families in the care of their child, the array of services available to families, and the integration of services.

Quality of providers. Providers often lack sufficient training or expertise in treating disorders of childhood and adolescence. This is especially true for pervasive developmental disorders, obsessive compulsive disorders, eating disorders, and other serious disorders that require highly specialized treatment. Shortages of well-trained clinicians can lead to unacceptably long waits for appointments, particularly in rural areas.

Involvement of families in the care of their child. Parents may not be meaningfully and respectfully engaged in the treatment process. They are sometimes treated in a patronizing or hostile manner and may be blamed for their child's problems. Families may feel coerced by the threat of having their child taken away by child protective agencies. The information that parents need to participate in a helpful and knowledgeable way is often not provided.

Comprehensive array of services. Treatment planning for children needs to take into account not only the diagnosis of the child but also the functioning of the family as a whole; only then can appropriate decisions be made about necessary services. Unfortunately, a comprehensive range of services including early intervention, home-based treatment, school-based treatment, residential treatment, and respite care is often unavailable, especially in rural communities. Respite care is nearly impossible to obtain and is an invaluable resource, especially for single parents.

Integration of services. Mental health treatment is not well integrated with other services provided to the child by the medical team, school personnel or others with substantial involvement with the child.

Key Features of a Quality Mental Health System

There is strong consensus among families with respect to key features of a mental health care system. These include access, appropriateness and quality and should be present regardless of whether a system is public or private, managed or not.

Access

Gatekeepers must have the experience and training to make appropriate decisions about the necessity of services and be able to advise consumers and family members about how to obtain help. Care should be available as close as possible to the communities in which the consumers/families live and should be delivered in a timely fashion.

Appropriateness

Specialists. Providers should have the experience and training necessary to care for adults with serious mental illness and children and adolescents with serious emotional disorders. Expertise in treatment of combined diagnoses of mental illness and substance abuse is essential.

Sensitivity to language and cultural issues. Consumers and families should not be prevented, by language or cultural issues, from receiving the information and care they need.

Quality

Standards of care. Care should be delivered in accordance with recognized standards of quality such as clinical practice guidelines. The processes and outcomes of care should be monitored and continuously improved.

Comprehensive care. Care for serious mental illness should be comprehensive. It should extend beyond traditional services such as psychotherapy, medication, and acute hospitalization. Day programs, employment assistance, residential services, treatment-oriented after school and summer programs for children can contribute enormously to the quality of life of consumers and families.

Coordinated care. Services within and among systems of care should be coordinated to maximize their effectiveness. Funds should be allocated specifically for the purpose of coordinating existing treatment resources. Coordination is critically important for people with combined diagnoses of mental illness and substance abuse. Special attention should be paid to the coordination of medical and mental health care since individuals with serious mental illness have a higher rate of premature death than the general population due to medical problems as well as suicide. The role of the case manager is vital and should be carefully defined. Some advocates prefer the title "care coordinator" because the use of the word "care" implies a standard of quality. (Eleanor Owen, NAMI, personal communication) The standard can be specifically defined and evaluated by objective criteria.

Education. Consumers and families need accurate, understandable information about mental illness and the services that exist to treat it. Information should be presented in a manner that is sensitive to cultural and religious differences and in a variety of languages.

Collaboration with consumers. Consumers should be engaged more fully in treatment planning and collaboration around issues of ongoing care. Mental health delivery

systems must recognize that while many consumers can anticipate recovery and may not need long term services, there is a significant minority who may have frequent relapses and will not be well served by transitional supports. They often need the structure and consistency of long term programs.

Collaboration with families. Providers, consumers, and families should work together whenever possible to assess family and community resources and to design and implement a comprehensive treatment plan. Family input can be crucial, not only in determining the consumer's needs and level of functioning, but also in recognizing the consumer's strengths and assets. Appreciation of skills can help to foster a more hopeful and respectful alliance among consumers, their families, and their care providers.

The Future of Family Advocacy

The energy, resourcefulness and dedication of families working on behalf of those with mental illness are remarkable and inspiring. Their efforts to increase public awareness of these disorders and to reduce the stigma associated with them have led to improvements in early identification and treatment.

Family advocates have an ambitious agenda for the future. Their efforts to this point have taught them the value of collaboration with one another, with consumers, and with other advocacy groups who attempt to speak for those whose voices may go unheard. Sometimes these collaborations, while expedient, are difficult due to differences in approach, philosophy, and priorities. For example, consumers and family members may have divergent opinions on issues such as involuntary treatment or confidentiality. Opinions may also differ about whether it is productive for consumers and family members to serve together on panels such as advisory boards for managed care organizations, although there are many examples of successful joint participation. As with any partnership, there must be a fundamental respect for the unique needs of each member as well as a commitment to mutual goals.

Advocacy Goals

Legislative advocacy. Issues including parity for mental health and substance abuse treatment, involuntary treatment, and inclusion of the most effective medications in formularies in the public and private sectors are paramount. Legislation to hold state governments and managed care organizations accountable for the services they provide and for divulging information about processes and outcomes of care are also sought. Advocates believe that consumers and families need legal protections to ensure that they will get needed services. Codifying these protections provides people with a mechanism for redress of grievances.

Federal guidelines. Advocates strongly believe that there should be nationwide guidelines requiring consumer and family involvement in developing and monitoring contracts

for delivery of services whenever public dollars are concerned. They suggest that the guidelines be strengthened by sanctions for noncompliance. Development of guidelines for the treatment of mental illness in the correctional system and serious emotional disturbance in the juvenile justice system are also considered priorities.

Data collection, analysis and dissemination. Advocates need access to high quality, timely information about who is being served in the mental health system, where, and how. Longitudinal data regarding the outcomes and costs of care are essential. Guidelines specifying the types of data to be collected across systems of care would be ideal. Sources of information should include the Federal government, public mental health authorities, departments of public health, public assistance, and correction, as well as managed care organizations. There should be an evaluation of what happens to individuals within and between systems of care. Data collection raises important ethical concerns about confidentiality: the goal of gathering data must not create a barrier that deters consumers from reaching out for the help they need.

Education. Advocates argue that education is key to reducing the stigma associated with mental illness. They urge ongoing work with the media to educate the public about issues of concern to consumers and their families and with school systems to identify children at risk for serious emotional disturbance and develop preventive strategies. Education can enhance recognition of mental illness as a disability and ensure protections against discrimination. Informing taxpayers of successful programs such as the Child and Adolescent Service System Program (CASSP) and Program for Assertive Community Training (PACT) will provide support for funding.

Educating families to seek help before a serious crisis emerges and developing consumer/family handbooks for each state, describing systems of care and available resources in the areas of housing, psychosocial rehabilitation, employment are important educational goals. Advocates also want to enhance communication among families of consumers. (e.g., NAMI is developing a web site with chatrooms and references.)

Education for advocates about the economics of mental health care will help them understand the forces that shape decisions so that they can make better-informed proposals. Similarly, creating coalitions among groups working on behalf of those who are struggling with homelessness, substance abuse, loss of health care benefits will advance all advocacy efforts.

This list hardly does justice to the hundreds of initiatives promoted by family advocates across the nation. Advocates believe that their message could be strengthened at this point by carefully considering their priorities and creating a document that expresses their philosophy and sets forth their agenda and suggestions for public policy.

The rapid changes in the delivery of mental health services have created new challenges and new opportunities for family advocacy. The greatest concern is that the historical mission of the public mental health system to care for the most vulnerable and underserved will be eroded by privatization and managed care. Family advocates

have worked tirelessly to create alliances with other advocacy groups, mental health providers, mental health system administrators and the public to ensure that the needs of people with mental illness are understood and responded to appropriately. Increasingly, family advocates are seen as legitimate partners in the design and delivery of quality mental health care for adults and children.

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Integrating Services for Children in the Era of Managed Care

**Susan Foster, Mary Armstrong, Cliff Davis, Mary Fleming,
Gretchen Graef, Marilyn Henderson, Mario Hernandez,
Barbara Huff, Lois Jones, Steve Kukic, Ronald W. Manderscheid,
Patric McCarthy, Alan Spader, Dorothy Webman**

Introduction and Background

Complex issues surround the integration of children's mental health services with other critical child- focused services in this era of transition to managed care and welfare reform. This paper reflects the perspectives of practitioners, advocates, and policy experts representing the fields of mental health, juvenile justice, child welfare, substance abuse, and education. Issues addressed include:

- a definition of service integration;
- major service integration efforts to date;
- benefits of service integration;
- the impact of managed care on service integration;
- strategies for child service integration;
- barriers to service integration;
- recommendations for the field.

Definition of Service Integration

There is no question that the development of a system of care for children across categorical agencies is a laudable idea. Stroul and Friedman's "systems of care" monograph (Stroul and Friedman, 1994) includes a definition along with a core set of values that are generally accepted in the field:

A system of care is a comprehensive spectrum of mental health and other necessary services which are organized into a coordinated network to meet the multiple and changing needs of children and adolescents with severe emotional disturbances and their families.

"Services," it is important to note, connote partnerships between health, mental health, education, substance abuse, child welfare, juvenile justice, children, youth, and families.

This notion of partnership harks back to the values associated with systems of care such as the central role of the family and the child, the value of serving families and children within their own communities and in natural settings, the provision of a comprehensive, flexible array of services, culturally competent care, and provider accountability that is based on child and family outcomes rather than the provision of a given service. In a managed care environment, questions remain as to whether or not these values can be retained, whether model mental health service delivery systems for children can be replicated, and whether systems of care improve child outcomes while containing costs. While system of care proponents have never claimed cost savings from this approach, the question of cost savings will arise in any managed care reform effort.

High-quality integrated service systems should have certain characteristics in common. To name a few: a single point of entry; multi-disciplinary assessment; individualized treatment; flexible programming; integration of acute and long-term benefits; and integration among multiple child-serving agencies (Stroul, 1993). Common outcomes are defined by all entities in the system based on the literature, current practice, and the capacity to collect outcomes-related data across systems (Epstein et al., 1996).

Major Service Integration Efforts to Date

Efforts at the local, state, and Federal level to integrate services for children have been underway for two decades, not only in mental health, but also in child welfare, maternal and child health, mental retardation/developmental disabilities, and related fields, but have not become commonplace until recently. Some have improved access to care, enhanced communication between providers and families, and demonstrated that agencies can work together creatively to improve service delivery. Several examples of initiatives in the broader child mental health field are described below; service integration efforts operating in managed care environments will be discussed later in this paper.

Little systematic research exists on the effectiveness of community-based systems of care, and none on programs developed specifically under a public managed behavioral health care system. There have been, however, a few significant national system reform efforts focusing on children with mental health needs. The demonstration projects of the Child and Adolescent Service System Program (CASSP) sponsored by the National Institute of Mental Health in the 1980's led to the development of a set of guiding principles for systems of care that are adhered to today (England and Cole, 1995; Stroul and Friedman, 1994). The Mental Health Services Program for Youth was a Robert Wood Johnson initiative that funded experiments in developing care management networks and in interagency restructuring to create partnerships among the categorical agencies responsible for children (Cross and Saxe, 1997). Although capitation was employed as a strategy at some sites, this project preceded the widespread adoption of managed behavioral health care at the state level. Whether or not the principles behind

these projects can be incorporated in a managed service delivery system is a subject of discussion in the field.

The Fort Bragg Experiment (Bickman et al., 1995) was a demonstration project that attempted to create a system of care for children with mental health needs. The project's comprehensive evaluation found that while the program succeeded in improving access to and fluidity of care, reconfiguring the system did not necessarily lead to improved child outcomes. Critics of the demonstration and its evaluation (Friedman and Burns, 1996) argue that Fort Bragg was neither a "system of care," at least according to the Stroul and Friedman philosophy on which it was based, nor a managed care system, as there were no incentives within the system to control costs.

Demonstration projects associated with Medicaid waivers and those funded by the Center for Mental Health Services (CMHS) are exploring capitation and other alternatives to fee-for-service that allow for more flexible service planning for children. CMHS, through its Comprehensive Community Mental Health Services for Children and Their Families Program, for example, provides funding to grantees to implement and evaluate systems of care for children with severe emotional disturbance (U.S. Department of Health and Human Services, 1996).

Legislative changes both at the Federal and the state level are blending funding streams and promoting programming that enhances interagency communication and planning in partnership with children and their families. Amendments to the Individuals with Disabilities Education Act passed in 1997 include enhancements regarding non-school providers and payments from other agencies such as Medicaid. Parental involvement also increases under the new law. (U.S. Department of Education, 1997)

Benefits of Service Integration

The primary benefit of service integration for children's care is that it addresses egregious problems in the system as it functions today. Currently, most care for children with multiple needs is too limited and fragmented. Overemphasis on expensive service providers, reactive, crisis-oriented interventions (often by removing the child from the home), insufficient focus on prevention, early identification, and timely treatment are due, in part, to categorical funding which narrowly focuses how dollars are spent. The lack of community and family involvement in service planning also plays a role in the misappropriation of service dollars (Friedman, 1994). Children with mental health needs may be served in a wide array of service settings, but rarely do these systems communicate, share information or resources, or transition children smoothly among themselves.

The consequences of fragmentation are manifold — and sometimes tragic. Juvenile justice and child welfare systems are often the recipients of children with extensive service needs, but are ill-equipped to address their mental health, educational, and social problems. The costs of caring for these children are too often passed off from one agency to another.

When a troubled child arrives in the emergency room on a weekend night, for example, it too often happens that no one agency will take fiscal responsibility for placement. Uninsured children end up in the child welfare system when their parents have to give up custody in order to obtain placement in a residential therapeutic setting. The stress on families as they weave their way through an increasingly complex patchwork of services to obtain the care their children need can be overwhelming, exhausting, and financially draining.

The potential benefits offered by an integrated service system speak for themselves: simplified access to a broad array of services and supports via a single point of entry; multi-disciplinary assessment; better family understanding of intervention approaches; individualized treatment; a continuum of care across multiple child-serving systems; flexible use of resources; a single point of accountability to the family; and integrated record keeping and data collection activities. Integration enhances accountability by ensuring that a specified provider is assigned responsibility for each interaction a child has with the service system. It also prevents cost-shifting, expands the range of services beyond those provided in any one service category, and eases the burden on families to coordinate their children's care.

The Impact of Managed Care on Service Integration

Depending on one's perspective, managed care presents either an opportunity or a barrier to the integration of children's services. Some advocates say that there are no models for integration within a managed care system, while others assert that managing care presents a unique chance to pull services together into a seamless whole. Still others suggest that an integrated service system is a managed care system.

When child-serving agencies at the state level design parallel managed care programs, each with their own mandate and contractual agreements, services continue to work in parallel rather than in concert, and the service system continues to be fragmented and confusing to consumers and their families. Parents and foster parents find it difficult to figure out where to obtain services and how to pay for them. Without an integrated managed care model that puts structures in place to coordinate multiple initiatives for children, confusion and fragmentation will result. (Osher et al., in press)

Many of the public managed care reform initiatives do include devices to promote or ensure service coordination, most notably case management for children and families with the most intensive service needs. Questions remain, though, as to the impact managed care will have on the poor and children of color and their families. Even though managed care organizations under contract with public mental health authorities are expected to promote community-based treatment, will the quality of care improve so long as cost savings is of paramount interest to the organizations and payers? As decision-making about care for children with mental health service needs shifts from states and counties to managed care organizations and other providers of managed services, children with

mental health needs (as many advocates have urged) are being treated more frequently in their homes and other community settings. Still, concerns are rife among families, youth, advocates, and providers that much that has been achieved with regard to stakeholder involvement and the provision of culturally competent services will be lost unless states and counties require that managed care organizations incorporate these values into service delivery. One particular fear is that as managed care organizations build service systems and provider networks, children with dual diagnoses will not receive the full range of mental health, substance abuse, and social services they need. Mental health and other services to people of color and linguistic minorities are often provided by ethnic-specific grassroots agencies. Some of these organizations will not survive in a business-oriented health care environment, thereby leaving their constituents without access to consumer-oriented care. Many are concerned that as states stop providing direct services, the needs of different cultural and socioeconomic groups will be ignored.

The desire to manage care has, in some cases, resulted in positive steps toward pulling services together and closing service gaps. In Arizona, for example, the state's managed behavioral health care organization altered its credentialing requirements to allow traditional healers to work with Native Americans. As a result, they increased capacity in a rural area with few services and increased access to culturally competent providers at the same time. The transition to managed care has also precipitated a much-needed dialogue regarding service integration at state and local levels among government officials, providers, advocates, and consumers. The reasons for this are complex and range from a need to survive economically in a changing health care market by pooling resources to a desire to improve the quality of care.

The question arises as to who is responsible, in the current health care environment, for integrating services. Is it the role of managed care organizations? Many argue that the behavior of managed care organizations and others contracted to provide managed service delivery in the public sector is determined by the expectations and actions of government and will assume the culture of the purchaser. Managed care organizations, for example, cannot alone create a care network for children entering the juvenile courts without a mandate from the state to do so. Moreover, managed care organizations cannot bring key players to the table to create service systems. Managed care organizations can create the networks to serve children with multiple needs, but they are limited to managing the system once it is integrated. Government, then, must play a role in promoting service integration. Some experts surmise that state officials are frustrated by the obstacles to integrated care and want managed care organizations to take over the work of service integration, to do the job that government cannot politically do. Unless both managed care organizations and government work together, fragmentation will persist.

The tools of managed care, such as utilization review, quality management, and procurement of networks, applied in the context of an integrated management system for

services for children and their families, have the potential to increase overall system effectiveness and improve child and family outcomes. Developed for adults, however, such tools may not prove useful or appropriate in developing integrated services on behalf of children.

Strategies for Child Service Integration

Service integration activities need to occur at three levels:

- the *client* level, via case management and other therapeutic models
- the *system* level, via structural and financial strategies
- the *policy* level, through community organizing, legislation and other activities at the highest governmental levels

No single strategy integrates a service system; rather, it is the cooperative efforts of providers, agency directors, local and state governments, managed care organizations, and families opting for an array of complementary strategies that promote service integration. For example, as much as case management can help children and families cope with and obtain access to and cope with a complex service system, case management alone will not integrate systems, *per se*. Without local government initiative, interagency collaboration, and appropriate fiscal incentives, service integration cannot occur.

Client-level Service Integration

Two direct service strategies that attempt to link services on behalf of children and their families are case management and wraparound interventions. Case management, often the primary direct service strategy employed in service integration efforts, refers to a range of activities from service authorization and utilization review over the telephone to direct contact with children and families, intensive coordination, brokering, assertive inter-provider planning, and advocacy. The classic managed care approach, aimed primarily at managing the system, consists of utilization review with a focus on controlling costs and does not necessitate in-person contact between the case manager and the child or family member. The human services approach, on the other hand, is aimed at improving access to care and outcomes for children and families while decreasing both gaps and overlaps in service.

Although many advocates and providers would like to see all children with mental health needs have access to a case manager who follows their care over time, has a positive relationship with the child and family, and ensures strong educational efforts that involve the family at every level, this “intensive” case management model is generally employed only with children with serious emotional disturbance and children in residential and foster care who are likely to use a variety of services over a long period of time. Some

states currently support the cost of intensive case management provided by managed care organizations. Other states initiated case management programs across agencies in the era prior to managed care. In Utah, for example, the state set up an integrated education, health, and human services system for special needs children at the elementary school level using a case management approach and a flexible pool of resources with which to provide appropriate services. The program is perceived by many as successful in identifying and addressing the needs of children and families as early as possible.

Managed care experience in private sector health care has demonstrated that the administrative, or gatekeeping form of case management, consisting of ongoing case monitoring and coordinated planning, applied to the most expensive portion of the population, can be effective at controlling costs. On the whole, efforts to evaluate cost savings attributable to case management have been problematic. Conducted by categorical agencies with a vested interest in proving that such a strategy is financially viable, savings may have been achieved through cost shifting. In order to objectively evaluate cost savings across systems, further study is needed; data must be shared and research efforts must be collaborative.

Wraparound is an integrative strategy that combines case management with an interdisciplinary team led by the parent or other primary caregiver who designs and approves the intervention. The team includes not only formal support persons but those individuals identified by the family as instrumental to the child's development. The model also requires that community teams composed of local stakeholders including parents, advocates, educators, juvenile court representatives, child welfare, health, and mental health personnel meet regularly to plan for the care of children and families in their communities. Such a labor-intensive model requires financial support from states and counties above and beyond categorical funding streams to support coordination activities that are otherwise not reimbursable.

System-level Service Integration

Systems-level strategies to achieve service integration involve financial strategies, structural and organizational strategies (e.g., staff outsourcing), identification of outcomes, and child tracking.

Financial strategies. One of the primary barriers to service integration is a line-item, compartmentalized approach to funding the agencies that serve children. Such funding drives virtually every aspect of system structure, manifesting an administrative burden replicated in each system. Categorical funding streams generally are mandated to cover narrow service responses to narrow populations, and such restrictions bar the way to service integration. Community agencies, therefore, are limited in what they can do and whom they can serve, which can bring them into conflict with community partners with similarly narrow funding boundaries. Recent waivers have begun to break this pattern.

A key to integrating services to children and, at the same time, achieving desired managed care efficiencies is to alter the structure of funding to support these services at the community level where people live and receive almost all of their services.

Key Federal funding for services to children such as Medicaid, Social Security, and Maternal and Child Health Services Block Grants determine the manner by which Federal, State, and local agency activities are structured, documented, and reimbursed. Financial strategies that allow for flexible, cross-agency planning for children with mental health and other needs, that contribute to service integration, and that assist in the achievement of certain valued goals such as home vs. residential placement (National Technical Assistance Center for Children's Mental Health, 1996) include:

- *Case-rate funding.* A fixed dollar amount is set per child per day and given to programs to provide an array of services. Milwaukee Wraparound, a system of care funded by CMHS, serves children in the juvenile justice system and those needing mental health services. The program uses a case-rate approach in which the child welfare agency certifies these children as "residential" and transfers a set dollar amount per child to the program to promote their return to the community.

- *Capitation (full or partial).* This commonly employed approach provides a fixed dollar amount for the care of an entire target population. North Carolina's Carolina Alternatives program has provided capitated contracts to ten pilot sites around the state to provide mental health, substance abuse, and other social services to children and families. The sites, predominantly community mental health centers, act as managed care entities; thus far, the program has seen a reduction in hospitalization among children with serious emotional disturbance.

Blended funding is considered the optimal strategy for achieving service integration. Using mechanisms such as capitation or case rate funding, agencies combine resources on behalf of children whose care they share. As a result, they optimize resources and demonstrate their commitment to service integration.

Numerous efforts toward blending funding streams are underway, but they require commitments from local and state governments and administrators at the highest levels to ensure that the systems work. Also known as "decategorization," these experiments in mental health services funding are being pursued by several states. In Iowa, decategorization boards were given the authority to spend money from 32 different funding streams for children, including child welfare, juvenile justice, and mental health (Friedman, 1994). The local boards kept the savings achieved by retaining children in the community (rather than in residential settings) and used them for creative programming to support the children in their homes. As a result, there has been a decrease in foster and residential care and an increase in dollars committed to keeping families intact. This program could not have worked without the commitment to the idea of integration that existed at the state level. Moreover, since this statewide initiative was in place prior to the advent of managed care, there was a well-established local mechanism, with funding

behind it, to negotiate with managed care organizations.

Structural and organizational strategies. Many programmatic efforts can bring children's services closer together organizationally: outsourcing staff to bring services from one agency into another; using interagency boards to bring key agency players together for joint program planning; and forming vertical (among multiple provider types such as hospitals and clinics) and horizontal (among mental health providers) networks to improve efficiency (Murphy, 1995).

Identification of outcomes. Functional outcomes, such as school attendance and independent living, appear thus far to be the most concrete and measurable markers used by localities responsible for certain child populations. Incentive-based outcomes that are geographically based have proven essential in promoting service integration at the local level. In several California counties, local agencies are working closely together to ensure that they improve outcomes for children because government payers have made the receipt of monies for children's services dependent on achieving agreed-upon outcomes. Other states and localities are working to identify common outcomes across service systems to determine whether interventions have an observable benefit. The Michigan Outcome Identification Project (Hernandez, et al., 1996) seeks to prioritize outcomes for the children's mental health system and to assess the level of agreement about outcomes from stakeholders inside and outside the public mental health system.

Child tracking. A clear goal of service integration is to be able to pinpoint the location of a child within the system and the services he or she is receiving and to ensure that the child does not get lost in the process. As systems of care are developed by states and counties, attempts are being made to track children across the service system. Tracking children from one system to another is essential to understanding where the gaps and duplications in service are, whether or not cost-shifting is occurring, and whether or not some children are slipping through the cracks. Current systems collect and store identifying and service data on consumers but, with little capacity for cross-walk among domains or across agencies, child tracking is difficult (Marzke, 1994). The Mental Health Statistical Improvement Program (MHSIP) developed data standards for children (MHSIP, 1992). It recognized that many children with mental health needs were not served by the specialty mental health system and therefore called for an expansion in data content to the entire system of care. To date, the MHSIP's recommendations have not been widely adopted.

At the Federal level, efforts are underway to create a prototype integrated information system for managed behavioral health care. States and localities are initiating data coordination efforts, some specifically for children and youth, to remove the information barriers to comprehensive service delivery. How these efforts will be coordinated with private sector managed care organizations with proprietary information systems of their own remains to be seen.

Better information across systems will improve care coordination and continuity of care as a child transitions from one system to another. Research to date on children's services has focused on individual sectors of the service system; at times this has resulted in misleading findings because it does not account for cost-shifting and for services provided by other systems. Integrated information systems will prove useful for collecting data for outcomes research and for evaluating the quality of care across the entire service system.

Policy-level Service Integration

Recent Medicaid waivers have increased flexibility to use funds to reduce out-of-home placements and provide community-based services, but such demonstrations are too early in implementation to be evaluated. Clear direction and incentives from all levels of government are required if agencies serving public sector clients are to work together. In Cincinnati, Ohio, for example, the county government combined funding streams from child welfare, juvenile justice, and mental health and contracted with a private, not-for-profit organization to which children with multiple needs were assigned for comprehensive service delivery. While this was a pioneering attempt by policy makers to blend funding, the contribution from each system was unequal, resulting in an assignment process that favored the larger contributors. An ideal blended funding initiative would ensure that all participating agencies contribute equally, conduct needs-based identification, and engage in collaborative intake, thereby guaranteeing that the most appropriate children were served.

California, where mental health services are administered and delivered at the county level, offers numerous examples of experiments in system of care development. In Ventura County, longstanding efforts at service integration were further supported by key legislation which promoted system of care development and provided fiscal incentives to serve youth at risk for out of home placements in the community. Legislation enacted in 1984, AB 3920, established a two year demonstration project to develop a model for a comprehensive, coordinated children's mental health system that could be replicated in other counties. The work in Ventura County is considered by many to be a model for the country.

Some local governments have undertaken integration efforts without divesting their responsibility for mental health service delivery to managed care organizations. A political movement toward service system reform underway in San Diego is being watched closely around the country. Three features make it unique: the county board of supervisors is driving the integration of funding for children with severe emotional disturbance in foster care and in residential treatment; families are equal partners along with government payers and providers; and the county has maintained its authority for the care of children and not divested it to a managed care entity.

Another policy-level means of integrating service delivery involves the creation of interagency agreements to provide a set of services to a given population. In Massachusetts,

the state Medicaid Bureau, motivated by a need to contain costs, and the state mental health authority drew up an Interagency Service Agreement to combine their dollars for acute care. These kinds of relationships are very difficult to forge, but they must be fostered to increase efficiency, make declining resources go further, and ensure that they continue.

Barriers to Service Integration

While everyone agrees that service integration for children is essential, in the real world it is difficult to implement and maintain. Federal and state legislatures have created multiple systems with narrow mandates. Each system feels accountable for its own mandated outcomes and fears that too much collaboration will limit its ability to fulfill its mandate and maintain its funding. Some categorical agencies are more difficult to pull into integrated service systems than others. Juvenile justice, for example, is often the point of system-entry for children with mental health needs, but, except for first time offenders who may get drug education, rarely do such children receive psychiatric evaluations. For all the children who do not commit violent crimes, a gap in the system exists. Society's punitive attitude toward children who commit crimes is a barrier in itself to treatment. A few courts do have their own mental health clinics or mental health providers they can call upon; linkage with other agencies, however, remains only rudimentary and is seen as one of the major impediments to service integration.

Over reliance on managed care organizations to pull services together constitutes another barrier. Managed care organizations have no inherent incentives to expend the resources necessary to bring child-serving agencies together; insofar as they do so, they simply carry out the expectations of public authorities. Some states, in an effort to save money, have shifted responsibility for children's mental health, have adopted pre-packaged benefits, and have failed to think more creatively, more holistically about the needs of children and their families.

Providing integrated mental health and other services to children in rural areas has its special challenges because there are often few services to integrate, few child-focused mental health providers, and large geographic distances to overcome. Moreover, people often avoid seeking social and mental health services in rural areas because it is more difficult to do so anonymously.

A final barrier resides in the lack of scientific evidence that service integration is efficacious *and* saves money. Proving both is particularly difficult. Data that exist are neither sophisticated nor integrated enough to provide proof of cost savings that can be linked directly to service integration efforts. Moreover, children are often factored into managed care contracts in the second or third year, making it impossible to collect longitudinal data. Where mental health care is provided by non-mental health professionals such as primary care physicians, school counselors, and non-reimbursable support persons, cost and outcome data are hidden.

Recommendations for the Field

The following recommendations for improving mental health and other services to children through service integration apply to states, the Federal government, researchers, families and consumers, and providers.

State Agency Responsibilities. States must promote and implement an interagency focus and interagency agreements to coordinate service provision and to avoid the proliferation of multiple managed care systems serving the same children. They should purchase high quality products that produce positive outcomes. Quality should take precedence over cost considerations. Their managed care contracts should set profit margins and mandate reinvestment pools for creative community-based programming. States and counties must identify those outcomes that are the most meaningful. Contracts must hold managed care organizations accountable for achieving these outcomes. Outcomes must include family satisfaction, maintaining children in school, providing neighborhood-based care, and using short-term therapeutic foster care.

Federal Agency Responsibilities. While innovation generally occurs at the local level, to maintain change, the Federal government can provide overall direction to states, managed care organizations, and localities. The Federal government should write legislation, disseminate guidelines and provide other informational materials to support and educate about service integration. It should show the public evidence of collaboration between Federal agencies, as is beginning to occur when Federal agencies co-sponsor conferences and write joint documents on service integration that are widely disseminated. Greater involvement of families in efforts to build systems of care could provide valuable insight to program planners in determining service array and in working with families on an ongoing basis. Service providers and families could co-facilitate training programs to enhance families' knowledge of managed care.

Improved coordination of Federally-funded regional technical assistance centers is essential. Continued funding is recommended for issue-specific (e.g., special needs, mental health, child welfare) training centers, but the government should, in addition, fund regional training centers with cross-system funding to disseminate information on the "how-to" of integrating systems and building consensus. It should also promote other technical assistance to state and community leaders, purchasers, and providers on how to evaluate the various options for developing a managed system of care and how to keep up to date with legislative changes. Providers need training on network development and integrated information systems to improve communication. Grassroots organizations, often the best equipped to serve children and families of color, need training to place themselves strategically in the market to ensure that they survive in a changing health care environment.

Research. The research agenda in the area of service integration should include rigorous evaluations of different types of systems and population-specific studies that track children through the system. To truly understand what happens both to the

children and to cost, a group of children in a managed service system should be tracked over a period of time. More research is needed into outcomes associated with blending of mental health, juvenile justice, education, and child welfare services.

Family and Consumer Involvement. As managed care companies become more involved in caring for children with mental health needs, families and children themselves need to take an active role in determining the services that will be provided. Managed care companies must truly incorporate families into the planning and implementation process. Youth should have a voice in their own care. They can, and do, participate on managed care organization boards.

Providers. Administrative strategies alone will not result in the highest quality integrated service system possible. Providers across systems must deliver clinical care that is consistent with the values and principles of the systems of care. This approach requires that providers from very different organizational cultures rethink how they view the people they serve to focus on child strengths, on all factors in the environment that impinge on the child's health, and on prevention. It is impossible to treat a child with mental health needs successfully without intervening with peers and families. Providers must listen to parents rather than assume that they are the cause of the child's problems. Clinical models that espouse such values should be applied across service systems and incorporated into a continuum of care.

Conclusion

It is clear that the concept of systems of care for children is well accepted by experts in the field and that efforts thus far in this direction have shown much promise in improving overall care to children with mental health needs. The current mental health care climate, as unsettling as it is to various constituencies serving children, presents an opportunity to link services that previously functioned in a fragmented or parallel manner, to improve overall efficiency, and to attend to quality and evaluation in a way never before experienced. What form such systems will take, and whether they will involve family partnerships in care and culturally competent services, remains to be seen. To develop fully the interagency partnerships that an integrated service system for children requires, each responsible party must expand its definition of the child and family to incorporate their multiple needs and strengths into service planning.

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Integration of Mental Health and Other Services for Adults

**Susan Foster, Ann Detrick, Stephen Eichler, Larry Fricks,
Marilyn J. Henderson, Joyce Jorgenson, Damian Kirwan,
Jeffrey Kushner, Ronald W. Manderscheid, Sandra Naylor-Goodwin,
Kirk Strosahl, Fred Volpe**

Introduction

There is little doubt that integrated services for persons with mental illness are preferable to services marked by fragmentation, duplication, and gaps in care. Persons with mental illness have multiple needs that cross categorical agency boundaries. They require an array of psychosocial services provided in an individualized, flexible manner by multidisciplinary groups of providers. Further, with the expansion of managed care, we are now in a period of major change that offers both opportunities for and barriers to service integration. Many believe that with managed care should come an efficient, integrated system of care that will meet the needs of persons who require multiple services. In an increasingly competitive market with shrinking resources, the incentives are in place for services to be better streamlined and linked into the efficient whole that service integration promises. Changes occurring simultaneously in health care, welfare, health care delivery in prisons, and eligibility for insurance and other entitlement programs make for more frequent movement from one system to the other — which, in turn, makes service integration efforts all the more important today.

This paper provides a broad overview of service integration. It begins with a definition of service integration and the characteristics of an ideal service system and then highlights the debate between advocates for “structural” vs. “functional” integration and describes models and methods to achieve both. Financial, contractual, and policy-level strategies for achieving better inter-organizational linkages are then discussed. A separate section is devoted to models for coordinating care between the justice system and the mental health system. Special issues including who needs to be involved in the process of designing and implementing systems of care, determining outcomes of care, and the challenges to service integration are discussed. Finally, recommendations are made for steps that should be taken to move toward more highly integrated service systems serving persons with mental illness.

Definition of Service Integration

Efforts to integrate services have existed for decades, initiated not only by mental health providers, but also by those in the areas of maternal and child health, substance abuse treatment, and social services. England and Goff (1993) define service integration as an "integrated financing and delivery system using a multidisciplinary panel of providers selected for quality and cost management and which involves continuous quality improvement principles." In the ideal integrated service system, providers are able to offer a flexible array of often neglected and non-reimbursable psychosocial services (Mechanic, 1994), tailored to individual needs in partnership with the consumer. Cross-agency service planning and positive collaborations between mental health and other relevant organizations serving the same population are essential steps to decrease fragmentation and create a system that functions seamlessly for each consumer.

Service integration reflects a holistic, consumer-centered philosophy of care. It takes into account the multiple needs of a person with mental illness, ensures parity between mental and physical health care, and focuses on prevention. Consumers nationwide insist upon the value of a comprehensive, consumer-driven, individualized approach toward recovery that includes meaningful employment opportunities, affordable housing, self-help programs, and alternative therapies. It is based on the respect and dignity that each person deserves as he or she moves forward in the process of recovery.

An integrated service system ideally includes the following features:

- a single point of entry into the system;
- multidisciplinary service teams of psychiatrists, nurses, social workers, and vocational rehabilitation specialists with consumers and families as integral members of the team;
- information systems that allow easy communication and sharing of data between organizations;
- services that are provided in an individualized, flexible manner and that ensure the consumer retains choice of treatment options;
- streamlined financing that decreases fragmentation and increases the flexible use of resources;
- a service array that includes mental health, health, vocational, social, self-help, and housing services;
- effective, ongoing partnerships among service providers, consumers, families and high level officials;
- a continuum of care from acute to community-based services with seamless transition from one to another; and
- care that addresses consumer needs over the course of a lifetime.

Strategies for Achieving Service Integration

Service integration is a process in which a variety of strategies are employed to create a system of care. Integration of services should occur on three levels: the *consumer* level; the *system* level; and the *policy* level. At the consumer level, services are generally linked through case management. At the system-level, integration is based on interagency collaborative arrangements and relationships among providers that directly shape the delivery of mental health and other services. Integration occurs when a variety of services are available in one location, or when there are agreements between provider agencies in different locations. At the policy level, service integration requires the development of new service delivery structures, approaches, and financing schemes, the creation of new services, and the legislation of multiagency budgets and service plans. Service integration efforts tend to be most successful when they are strongly developed at all three levels (Teitelbaum et al., 1997).

How to achieve service integration is an area of debate in the field.¹ Should services be linked structurally, through location of services under one roof, or functionally, through a variety of strategies that do not require co-location? The following sections describe arguments for both approaches to service integration, methods for achieving both, and models currently in existence.

Structural Integration Strategies

Advocates for structural integration point to numerous advantages to providing an array of services in one setting (Strosahl, 1994; Feingold and Slammon, 1993). People benefit from services delivered in the same location by providers with similar philosophies who are in constant communication with one another and who work as a team under the same roof; at the same time, consumers are spared the burden of going to multiple sites to obtain the services they need. With support from mental health specialists, primary care physicians, often the first point of contact for persons seeking mental health care, can detect and manage the majority of mental health concerns (Strosahl, 1994). In rural areas, where it is particularly difficult to move through society anonymously, there is stigma associated with going to a mental health center, whereas primary care is seen as a necessary and "normal" service.

Many HMOs have, for some years, provided both primary care and mental health services, but the mental health consultant model at Group Health of Puget Sound in

¹ Much of the mental health policy literature on service integration focuses on the relationship between primary care and mental health services, but this paper will also draw from the justice system, substance abuse, and clinical literature to discuss other key systems that must be considered in any discussion of comprehensive service integration.

Washington State is considered by many to be a model for effective collaboration between mental health and primary care providers. This HMO serves a predominantly middle class, privately insured, population, but certain aspects of the model may have applicability to the public mental health system. Here, mental health consultants conduct treatment planning and brief interventions in mental health and substance abuse in concert with primary care physicians. The mental health consultant continues to be available to the consumer and to the physician, but the primary care physician directs the care. Specialty care is provided for persons with serious mental illness or during acute episodes. As Arons et al., (1994) have asserted, not only is it more effective to treat mental health and substance abuse in an integrated fashion, but "the ability to manage mental health and substance abuse services is central to full integration."

One rural initiative, the Bay Area Service Extension Project, in northern Michigan (National Association for Rural Mental Health, 1995) is considered to be a successful integration of primary care and mental health. The project outsourced mental health practitioners to tribal health clinics. The key to the program's success, however, was the receptivity of the physicians to such an arrangement. Physicians found that they were better able to identify mental health problems among their patient populations because they had the support they needed to ensure rapid access to consultation, crisis intervention, and ongoing treatment.

It may be naive to assume that simply providing mental health services in primary care settings is the answer to integrating mental and physical health. Over dependence on primary care physicians to take the lead in the management of mental health needs can result in the under detection of mental illness. Wells and his colleagues (1989) found that general medical providers, when operating solo, detected only about half of the depressed individuals in their practices, as opposed to mental health specialists, who identified almost all. There is also no guarantee that physicians will be aware of the skills of mental health practitioners or receptive to bringing them into their practices (Badger, 1997).

For structural integration initiatives to work, medical and mental health providers must share a common philosophy of care and operate in an atmosphere of mutual respect. In such an atmosphere, mental health is *not* devalued; rather, emotional and physical health are viewed as intimately connected. The package must also be tailored to the population served. Services can be located together in a variety of settings, but should reflect the perceived health, mental health, and social needs of the community being served. For example, services could be offered in public housing developments, schools, ethnic-specific organizations and other neighborhood settings.

Finally, structural integration only works when there are services to locate in the same place. According to Damian Kerwin of the National Association for Rural Mental Health, there are over 1000 counties in this country with no mental health providers whatsoever. Goldsmith and his colleagues (1997) found that while most rural areas had

some form of ambulatory mental health services, there was a general lack of adequate and appropriate care for persons with mental health needs at all levels of care. No managed care plan or integrative strategy can overcome the dearth of providers and geographic isolation of individuals in rural and frontier locations with mental health needs; other creative solutions must be sought.

Overall, the arguments for co-location as a strategy for developing integrated service systems, are strong, but proponents recognize that this approach is not always feasible and that it is more important to judge a service integration initiative by how well it works rather than by how it is structured.

Functional Integration Strategies

Advocates for carved out mental health services with “functional” integration argue that the way a system functions is more important than how it is physically structured. When organizational players work collaboratively, often assisted by case managers, they achieve a “functionally integrated carve-out.” To Croze (1994), “integration is about eliminating boundaries, about productive collaboration; it does not require that specialty systems of care be completely merged.” Proponents of functional integration express concern that when mental health services are provided in medical settings, the medical model prevails, mental health services are devalued, and access to alternative and specialty services is limited.

Case management. While co-location of diverse services is a system-level service integration strategy, case management is the most widely used technique at the consumer level for linking consumers to a range of services in different locations. This strategy is dependent on an individual, hired by an agency, to bring service system components together on behalf of consumers, or to functionally integrate services for them. “Case management” can connote a range of functions, from phone-based gatekeeping to outreach, assessment, and long-term collaboration with consumers to enhance their quality of life, social and occupational functioning, and recovery through supportive counseling and service referral and follow-up. Managed care organizations have found the more intensive forms of case management particularly useful with persons with severe and persistent mental illness (Surles, 1992). The gatekeeping, or brokering, type of case management, is employed more to control than to increase access to services and can result in reduced choice on the part of the consumer and decreased flexibility on the part of the provider.

Planners sometimes make the mistake of depending on a case manager to integrate systems. Because they are closest to consumers and their families, case managers are more likely than other personnel to identify system-level problems, but they cannot change systems. They usually have little or no contact with organizational and political leaders who have the authority to effect systemic change. Service system implementation and

sustainability are most likely to be successful when administrators value case managers' observations by including them in the decision-making process.

System-level Strategies. While case management seeks to coordinate care on behalf of consumers and their families, various system-level strategies may be used to integrate therapies and organizational functions to address the needs of the whole person and the systems surrounding that person. These interventions require the service system to respond collectively to individuals with mental health needs.

Organizational innovations require managerial level investment and planning across agencies. They include development of common intake forms, shared access to records, cross-agency needs assessments, integrated referral and feedback systems, formation of multi-disciplinary and multi-agency teams which meet regularly to conduct joint care planning, and interagency sharing of staff and other resources.

Certain treatment approaches are viewed as beneficial to persons served by several service systems and those with co-occurring disorders such as mental illness and substance abuse. Multi-systemic therapy (MST) (Santos et al., 1995) approaches treatment from the perspective of the multifactorial nature of mental illness and recovery and focuses on consumer strengths and prevention. Its values are consistent with those espoused by managed mental health care (Henggeler et al., 1996). MST stresses, for example, improving practice standards by providing incentives for those clinicians who achieve positive outcomes. Advocates of this approach acknowledge that while such a model is integral to providing consistent care across agencies, without a supportive system of care, it will not be successful.

Another model, the Program for Assertive Community Treatment (PACT), has been rigorously evaluated and extensively replicated. Widely accepted by consumers and providers alike, assertive community treatment is viewed as an effective means by which to address the multiple needs of persons with mental illness through intensive case management within a multidisciplinary team (Gilbert, 1997). PACT began in Wisconsin in the 1970s as part of the Training in Community Living Model (Frank, 1997).

PACT stands out among community-based mental health programs because it contains a number of elements considered important to mental health providers, consumers, and advocates and to those who view service integration as essential to quality care for persons with mental illness. First, case managers operate as part of a multidisciplinary team of mental health clinicians, nurses, and vocational rehabilitation specialists. Rather than brokering services scattered across many institutions and agencies, the case manager works with a coordinated, cross-agency, and ongoing team that includes the consumer. Second, the team performs all direct services for the consumer, including psychiatric evaluation and treatment, medication management, drug treatment, nursing and social support, and social and vocational rehabilitation. Third, consumers take an active role in their recovery by living and working in the community and by partnering with the team to determine the level of support they require. Finally, employment is a valued goal

in the program, and support for becoming and staying employed is considered essential to recovery. The inclusion of a vocational rehabilitation specialist on the team is seen by consumer advocates as essential to an integrated service delivery model.

The National Alliance for the Mentally Ill has formed a partnership with PACT, Inc. to promote replication of the model and marketing to managed mental health care organizations in the belief that this is the most effective community-based service delivery model (Flynn et al., 1997). PACT's strengths in a managed care marketplace include its cost-effectiveness for persons with severe and persistent mental illness. Research on the model has also shown that the greatest benefit is achieved when services are provided over the long-term; hence, managed care organizations will be most interested in the model if they have long-term contracts with states and other payers.

Different models of integrated service delivery may be best applied to different populations. While PACT may be most effective as a long-term intervention for persons with serious and persistent mental illness, the HMO model described earlier may be more appropriate with persons who have less severe illness, intact support systems, and fewer concrete needs. The implication for managed care is that an assessment of the severity or chronicity of the illness, of culture, economic status, service availability, and geography must be conducted before a service model, however integrated, is applied to a given community.

Information Systems. It is believed by many that information systems and other telecommunications technology can "virtually" integrate systems. They have the capacity to support collaborative planning and service delivery among service providers at different locations via electronic and telephone communication, computerized exchange of information, and interagency referral tracking, thereby precluding the need to locate providers in one physical setting. The Internet is a source of information on treatment modalities, support groups, not only for consumers but also providers. Some group practices allow consumers to schedule appointments via the Internet (Trabin, 1996).

While some of these functions are already in place and accessible to many, an integrated information system that provides real-time knowledge of consumer functioning, service utilization, outcomes assessment, and system performance across agencies does not yet exist. Such a system could assist providers and program planners to respond rapidly to consumer-level and system-level problems and to assure that appropriate and timely services are delivered to the consumer.

A fully integrated information system would allow all providers and administrators access to consumer enrollment and utilization data. Providers and administrators would use standardized performance measures, practice guidelines, and outcome measures. Optimally, such a system would allow for consumer tracking across systems to identify gaps and duplication in service as an indicator of level of service integration. Within the information system, there would be linkages among areas so that analyzed together, these data could be used for ongoing quality assessment and overall program evaluation.

Numerous efforts are under way at the Federal level to develop measurement standards and prototypes for each of these areas, but an overall information system strategy, involving cooperation between the private and public sectors, needs to occur simultaneously with system reform.

The technology exists to create such systems, but the data systems and capabilities across public sector agencies and between public and private sector entities vary tremendously. Further, providers are often linked to multiple managed care networks, all with their own information systems and requirements. Numerous barriers related to cost, confidentiality, standardization, measurement, and how data are used and interpreted have to be overcome before truly integrated information systems can be implemented. Consumers, family members, and other advocates have been and must continue to be involved in the design and implementation of such systems.

In rural areas, where services and providers are separated by great distances, technology can facilitate consultation, medication monitoring, and care planning. Telepsychiatry has proven a useful means of bringing specialist consultation to remote areas and creating teams where none existed. One successful and creative example of such networking is in Arizona where services were provided to Navajos using satellite technology for psychiatric consultation to Navajo healers who provided direct service on the reservation. Teams that travel from town to rural community mental health centers or primary care offices achieve the same ends, but video technology saves the time and expense incurred through travel.

Financial Strategies

Across the United States, numerous natural experiments are taking place in financial restructuring to effect service integration. Capitation, now widely practiced in the public and private sectors, is a financial strategy that has great potential for facilitating integration. Operating from a pool of funding for a focused population, providers technically have the flexibility to develop a spectrum of services, including prevention, employment coaching, and wellness services, applied individually according to need. Organizations and provider networks, and even county mental health authorities, are increasingly willing to use such arrangements to provide a continuum of services.

While capitation allows for creativity and flexibility, there is little research evidence to suggest that it integrates services (Frank, 1997). Capitation may, in fact, result in decreased access to specialty services because the provider organization bears financial risk and therefore has the incentive to provide care at as low cost as possible. In today's competitive health care market, some organizations are accepting low capitation rates to obtain contracts and are therefore forced to reduce the number of services, and to restrict choice in the frequency, intensity, and types of services they use. For example, long-term psycho-therapy or inpatient substance abuse treatment may not be available in a

capitated plan. This is of particular concern for people of color and low income populations who may wish to seek services from ethnic-specific organizations, or require translation, outreach, and home-based treatment (Lipson, 1997). Other dangers include selection of the lowest risk client base and "dumping" potentially high-end users into other payment systems. As long as selection and cost shifting occur, a service system cannot be considered fully integrated. Safeguards must be in place in the payer-provider contractual arrangement to ensure that quality is maintained and that optimal outcomes, standards of access, range of services, and availability of providers, are achieved. (Wells et al., 1995; McGuirk et al., 1995)

Blended funding initiatives attempt to consolidate multiple funding sources into a single stream to reduce fragmentation. In this way, the resources committed by various agencies (e.g., mental health, substance abuse, and corrections) to a given population are streamlined to provide a range of services in the most efficient way possible. Such a process requires planning at all levels of government and cooperation between treatment organizations and agencies to determine which funding streams should be consolidated and to what end. Such initiatives are rare for adults, but have been piloted to integrate children's services.

Contracting Strategies

A mental health service contract can be an integrative strategy when it builds in requirements that the contractor demonstrate efforts toward linking services on behalf of the population served. The contract enables the payer to obtain a service array that is responsive to the needs of consumers and their families. At its best, a contract can specify the mechanisms for integration between community organizations and systems; fiscal responsibilities across agencies; instruments for measuring consumer satisfaction with service array, availability, and access; interdisciplinary training requirements; and specific outcomes measures.

In the earliest days of managed mental health care carve-outs, states' contracts with managed care organizations required little in the way of innovation to improve the quality of care to persons with mental illness; states tended to accept the packages that were offered to them. Experience coupled with increased competition for public sector contracts has enabled purchasers to be proactive in specifying the populations that need to be served and the strategies that must be employed to enhance quality of care. A recent study of Medicaid managed care contracts (Rosenbaum et al., 1998) found that while state Medicaid agencies have begun to consider the relationship between managed care organizations and other agencies serving persons with mental illness (particularly between mental health and drug treatment programs), their contracts with these organizations often use ambiguous language to define "coordination," none set standards for the achievement of integrated service delivery, and few specify interagency fiscal responsibilities for the

populations they share. The authors warn that without specifications for interagency interaction and proper monitoring of steps toward service integration, carve-out contracting can exacerbate fragmentation and gaps in coverage and service. While contracting has the potential to drive systems of care, its potential as a strategy has not yet been realized.

Policy Level Strategies

At the policy level, service integration involves building support for specific programs and for collaborative and interdisciplinary approaches to care. States are increasingly legislating the merger of categorical agencies that serve the same populations. City, county, and statewide planning in conjunction with heads of public and private agencies, task forces, and boards is also occurring. This kind of broad-based planning has the potential to build lasting support for institutional linkages and interagency/interdisciplinary program approaches in policy-making circles.

In several states, shifts in responsibility and funding for mental health and other human services from a centralized bureaucracy to counties and regions has given local planners the autonomy to consider the unique needs of its vulnerable populations and to plan for services across systems. The planning process can be tremendously complex and requires collaboration among all stakeholders at all levels to make it a success. California is the most prominent example of a county-operated mental health (and recently, human service) environment. As the state has also operated for a longer period of time than most within a managed care environment, it offers some interesting service integration examples. In Los Angeles County, Integrated Service Agencies (ISAs) were formed to provide all mental health and social services to individuals in their catchment areas 7 days a week, 24 hours a day. This initiative holds promise for truly integrating services because it employs an array of strategies: blended funding, capitation, and case management. It also involves a local planning process and identifies a locus of accountability for persons with mental health needs.

New York, which has been slower to move to managed mental health care, has benefitted from observing other states make the transition. Rather than carving out mental health services to a managed care organization, New York's Department of Mental Health regionalized the delivery of mental health services and recently issued a request for proposals to regions to deliver mental health services to over half of the serious mental illness population. In response to the request, providers formed multi-organization consortia to create networks that provide an array of integrated services.

Indicators of successful change at the policy level include: a commitment to change on the part of key stakeholders; strong leadership at all levels of the service systems targeted for integration as well as among the funding sources that support these systems; and a planning team that is representative of the community's different service provider, cultural, and ethnic groups (GAO, 1992; Marzke and Both, 1994).

Coordinating Care Between the Justice and Mental Health/Substance Abuse Systems

Prisons have become primary institutions in which persons with mental illness and chemical dependency are housed (Torrey, 1995). Often jailed for non-violent or drug-related offenses, persons with mental illness may receive medications and some form of mental health treatment in jail, but rarely receive the follow-up and care they need upon release. As a result, they become trapped in the revolving door between the mental health and corrections systems. There are, however, two strategies for integrating services, diversion and unified drug courts, that help retain persons with mental health and drug treatment needs in the community.

Diversion is intended to prevent unnecessary incarceration and recidivism for persons who commit non-violent crimes. Often, these persons have mental health and substance abuse needs that are better addressed in the community than in a correctional facility. The best diversion programs, according to a review by Steadman et al. (1995), have mechanisms to integrate mental health and corrections functions (e.g., by placing mental health professionals in courts) but also work within an integrated community-based system of services and set aside resources (such as liaisons and case managers) to ensure that those linkages take place.

Milwaukee's Community Support Program serves individuals with severe and persistent mental illness who have been released from prison and who are at high risk for reincarceration, homelessness, and decompensation as a result of poor medication and therapeutic monitoring. A multidisciplinary team includes paraprofessionals housed in a small, community-based setting that provides medical and therapeutic services, assistance with money management and housing, and close monitoring. Staff also provide outreach to local prisons and jails to identify and offer services to qualifying individuals. The program has not been formally evaluated, but factors in its perceived success are its low-cost identification of persons with mental illness in prisons, and improved relations between agencies involved with mentally ill persons within and outside the corrections system. (McDonald and Teitelbaum, 1994).

Unified drug courts link the judicial, corrections, and mental health/substance abuse service systems. Prior to conviction, an offender is referred by a judge to mandatory drug treatment; upon successful completion of a drug treatment program (with no subsequent arrests), the criminal record is erased. In a St. Louis, Missouri unified drug court, a combination of public health, judicial, and financial approaches from the local to the state level makes it possible for individuals without health insurance to receive immediate drug treatment. Moreover, pre-treatment, inpatient treatment, and aftercare, covering a year of services, is included in the package.

In addition, certain managed care principles have been applied successfully to these types of programs that include: contracts between the state and a network of providers and managed care organizations for a case rate per member per month for pretreatment

and aftercare; measurement of outcomes to evaluate the performance for contracted providers (e.g., employment, sobriety, percent who graduate from treatment, and percent who go to jail); levels of care criteria to appropriately place clients; a quality assurance plan and monitoring; and a holistic approach to medical necessity.

Special Issues in Planning Service Integration

Who Needs to be Involved in the Process?

If one considers that system reform, in this case the development of integrated service delivery systems for persons with mental illness, is a process rather than a single event, the process should reflect the needs and concerns of the population to be served. The creation and maintenance of such systems requires cooperation and positive working relationships among all involved parties from consumers to families, agencies, and policy-makers.

Bruner (1994) notes that such a process involves partnering with consumers and families at the local level, conducting community-based needs assessments to reach consensus on goals and objectives, and developing mechanisms for problem resolution. Families and consumers should be involved in the design, development, delivery, and quality assurance processes of managed care services. Participants must also reflect the culture of the community served.

Some mental health specialists maintain that market forces and strategic purchasing of services will, without government intervention, do a superior job of creating well-functioning integrated service systems. Most, however, believe that government must continue to play a vital role in maintaining safeguards that ensure that disenfranchised populations such as persons with severe mental illness, specifically those who are poor, homeless, and people of color, receive the services they need.

Outcomes

A well-functioning integrated service delivery system must be outcome-driven. In other words, outcomes for the population served must be linked to common goals that reflect the diversity of customers served, the multiple services they receive, and the settings in which they are served. Promoting an outcomes orientation and accountability for achieving results are crucial steps in the process of implementing service integration (Schorr, 1994). Determining the means by which those agencies should be held accountable for consumer outcomes is a challenge; one option is to provide fiscal incentives based on outcomes such as job retention, consumer satisfaction, and maintenance in the community.

Challenges to Service Integration

Service integration is not easy to achieve or sustain, which may explain why there are no ideal service systems in place. Service integration requires collaboration among agencies with different missions and funding sources; hence, it is not surprising that integration is a difficult goal to reach. Moreover, philosophies that differ across agencies and professional disciplines can hamper dialogue. For example, if the goal is to blend funds to provide case management, it can be difficult to obtain the commitment of resources from agencies that have different opinions as to its value.

Categorical funding requirements from the Federal to the local level constrain programs' ability to work together by creating multiple systems with narrow mandates. Moreover, as funding flows less freely, managing turf conflicts and competition among organizations participating in service integration efforts presents a universal challenge. At the policy-making level, a lack of commitment, support, and leadership, as well as uncertainty over funding availability, can result in turf battles between state and local officials who may see service integration as a threat to their programs and budgets. (GAO, 1992)

Service systems will never be truly integrated without integrated information systems, both within mental health and across agencies. Currently, data collected, instruments used, and level of computerization vary by agency, by area of jurisdiction, and between the public and private sectors. At present, there is no integrated information system in existence, although components of such a system are being used by various organizations and government bodies.

Proving that system reform leads to improved clinical outcomes remains elusive. While it is assumed that integrated service systems are better for the consumer, the field has not reached consensus on defining the most important outcomes across service systems. Finally, some service areas, particularly rural ones, have few services and few service providers to integrate. Rural areas have unique needs (e.g., reimbursement for provider and client travel) that tend not to be addressed at the state level because of their low population density. There may also be resistance on the part of primary care physicians to working with mental health providers.

Recommendations

The expert panel made several recommendations for service integration efforts in the future:

Funding Mechanisms. Financial incentives are a key method for changing models of care for persons with multiple needs. Capitation and consolidation of funding streams have great possibilities for the development of service systems that are flexible and comprehensive. New funding mechanisms and risk arrangements must be accom-

panied by close monitoring and service requirements to ensure that an elastic, individualized system results.

Public and private sector purchasers alike can change the shape of mental health service delivery if they set contract parameters for system of care development. The contract is a powerful tool for purchasing an integrated continuum of services. It is the payer's responsibility to require the integration of mental health and primary care along with other key services, to remain involved in the design, delivery, and evaluation of services, and to ensure that appropriate outcomes are identified.

Funding should be provided to states and localities to facilitate planning toward service integration. Such processes are time- and labor-intensive, requiring personnel to facilitate interagency communication, cross-training, and other activities to initiate and sustain system reform.

Research. As much as service integration is accepted as a worthy goal, there is insufficient evidence that increasing system integration improves quality of care or improves consumer outcomes. Tracking individuals across systems longitudinally would yield the best information as to whether or not integration efforts were closing gaps and reducing duplication in the system. Overcoming such barriers as creating common identifiers across systems while still protecting consumer privacy are challenges researchers face in these endeavors. There are several natural experiments in service integration in progress across the country that could (and are) being studied using quasi-experimental designs and ethnographic approaches. Not enough time has passed to assess the results of such initiatives, but it is clear that they must be thoroughly evaluated in order to determine whether or not programs are successful, which aspects of the programs have the greatest impact, and whether or not the results are generalizable. Various strategies are being employed to integrate mental health and other services, but in what combinations as applied to which populations requires further study.

Rural Areas. In rural areas, use of primary care settings for mental health interventions can be viable alternatives to mental health centers, which are viewed by some rural residents as stigmatizing. But in order for this model to work, training for physicians is required to enhance their ability to identify and treat mental illness and substance abuse. Medical students and mental health trainees should be given rural practice opportunities in collaboration with professionals in both disciplines to introduce them to the model of co-located mental health and primary care and to entice them to practice in rural areas.

Allocation of funds to rural areas tends to be limited, and consideration of the unique needs of rural providers for transportation funding should be made. Where services are few and far between, consultation, team meetings, referrals, and other activities that link different services can be achieved through satellite technology.

Rural counties can pool resources and join together strategically to advocate for better, more creative means of delivering a variety of services to their constituents. Documentation of rural service integration projects that seem to be making a difference should be disseminated to communities and to state legislators.

Technical Assistance. Local governments need technical assistance to understand managed care and to learn about creative program strategies under capitated systems. Local stakeholders also need training in leadership, consensus-building, and other strategies that promote interagency collaboration and commitment to persons with mental illness.

Information Systems. There are, at present, no fully integrated information systems that can provide 'real time' consumer and program data for the improvement of service delivery, and no system can be truly integrated without it. Technological experts, as well as experts in mental health data, consumers, and epidemiologists must work together to determine which questions are most important to answer so that information is gathered purposefully. Consensus must be attained on content, measurement, and use of data; confidentiality concerns must be addressed; and the infrastructure to support such a decision support system needs to be built. Efforts to date such as MHSIP's consumer-oriented report card (1996) are important and need to continue.

Consumers and Families. If, indeed, service integration efforts call for a common philosophy across agencies, consumers call for a focus on recovery, self-help, and reintegration into the community. Consumers and families need to be involved as decision makers throughout the design and implementation phases of service integration efforts. Recognition of the right of these constituencies to meaningful participation will help people recover from mental illness and become more fully participating members of society. Twenty-five states now have offices of consumer relations.

Outcomes. Just as it is important to identify goals and objectives collaboratively, outcomes should be identified that are tailored to specific populations. Clinical outcomes may not ultimately be as important as functional outcomes such as job retention and stable housing. If the mental health field can settle on consumer-centered outcomes with realistic time frames for their achievement, it will be able to contribute to larger efforts at bringing human services toward an integrated whole.

Conclusion

The financial strategies and contracting incentives associated with managed mental health care have tremendous possibilities for promoting service integration. Capitation can free organizations from strictures on the types and range of services that can be provided and make flexible, creative programming possible. The efficiencies required in an era of dwindling resources have reignited a movement toward community-based care and have made policy makers and planners join with consumers and families to advocate for comprehensive programs that sustain individuals in their communities. The public mental health system is requiring the managed care entities with which it contracts to demonstrate the ability to serve individuals with mental health needs across systems such as corrections, primary care, and drug treatment. While there is insufficient evidence that service system reform improves the quality of care and outcomes,

it is clear that physical, emotional, and substance abuse issues are inextricably linked and must be treated in an integrated fashion.

Ultimately, how successful service integration initiatives will be will not rest on financial incentives. Service integration is a process that requires collaboration, networking, and compromise on the part of players in different systems and at all levels. A participatory process that includes the public sector, the private sector, providers, consumers, and families is crucial to ensuring that the most vulnerable populations maintain choice and access to the range of services they require. There is no single strategy that will ensure that service integration takes place; the best initiatives will combine financial, consumer-level, technological, and other systems innovations to create systems of care that have a lasting effect on the quality of care for individuals with mental health needs.

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Partners or Antagonists: Medicaid and the Public Mental Health Agency in the Era of Managed Care

**James O. Michel, John Allen, Bruce Bullen, Jack Callaghan,
Rick Compton, Marilyn J. Henderson, Gene Lovato,
Ronald W. Manderscheid, Noel Mazade, Candace Nardini, Lee Partridge,
Randy Poulsen, E. Clarke Ross, Marylou Sudders, James Wiley**

The failure in the early 1990s to reach consensus between the Administration and Congress regarding the shape of national health care reform has fueled the continuing efforts of individual states to address an array of lingering problems, principally through Medicaid managed care initiatives. These programs are intended to control spiraling costs, expand coverage and access to services, and improve quality of care. The recent relaxation of waiver requirements in the Omnibus Budget Reconciliation Act is likely to continue this trend. Within this environment, mental health has perhaps been the most prominent specialty service to command the attention of Medicaid directors across the nation. Although payments for mental health and substance abuse treatment services represent only about a quarter of total Medicaid expenditures, inflation rates for these services have typically been higher than the already steep rate of medical cost increases. While public mental health directors have been busy completing a process of downsizing large public institutions, attempting to develop and consolidate community-based systems of care, and supporting a burgeoning consumer movement, they have had to cope with a rapidly changing business landscape reflected through changes in the Medicaid program.

The goal of this paper is to examine the manner in which structural, procedural, and political aspects of the relationship between Medicaid and the public Mental Health Agency (MHA) impact the design and implementation of managed care initiatives. Of particular interest are the variables impacting the manner in which Medicaid and the public MHA work together, or at cross purposes, in setting the course of public mental health policy. Acknowledging the unique fashion in which individual states organize and finance their public mental health systems, the current paper will:

- discuss the manner in which Medicaid and the public MHA typically take either similar or divergent approaches to eligible populations, benefit design, purchasing strategies, provider networks, quality management, financial management and other administrative functions;
- identify areas of both collaboration and conflict, using examples of existing managed care initiatives; and

- suggest possible strategies to enhance cooperation.

Payer, Purchaser, Provider

It is helpful to conceptualize the management of the public mental health system in terms of three broad functional categories: governance, systems administration, and service provision. Central to the *governance* function are the key political/public policy decisions regarding who will be served and how much public money shall be allocated. Governance is the true province of public policy makers, including the executive and legislative branches of government, plus the direct stakeholders, especially consumers and advocates. *Systems administration* refers to the set of operational activities required to implement policy, i.e., network development and management, financial management, information management, and quality management. Operating the public mental health system has long been the (fairly exclusive) province of the MHA, but one of the major questions today is whether some or all of the systems management tasks can be more efficiently and effectively handled by for-profit or not-for-profit private sector managed care organizations including managed mental health care organizations. In the public mental health system, a mix of public and private, mainly nonprofit, inpatient and community-based organizations have traditionally been responsible for *service provision*. The manner in which service provider networks are selected and managed is another area of debate regarding efficiency and effectiveness.

As a 'mere' payer for a discrete set of mental health services, Medicaid has not historically taken a great interest in the overall systems management function of the public mental health system. Indeed many would describe Medicaid's pre-managed care participation in the governance function as fairly passive: in most states Medicaid allowed itself to be a financing source for the deinstitutionalization/community development policy which was shaped by the MHA. Two factors have significantly altered this state of affairs: first, Medicaid's financial stake in mental health services has increased significantly (to the point where it is the dominant payer for certain services), and second, Medicaid has begun to enroll increasingly larger percentages of its recipients into managed care plans.

During the 1980s, Medicaid came to represent a major source of funding for mental health and substance abuse treatment services. As MHA directors began to pursue mainstreaming campaigns, clients under their care who required inpatient services increasingly were hospitalized in community general hospitals using Medicaid financing. At the same time, many MHA directors began to collaborate with their Medicaid counterparts to implement optional clinic and rehabilitation services. By 1994, total Medicaid reimbursement for mental health was \$22.9 billion, accounting for almost half the funding for public services (Oss, 1995). Other public funding of mental health included state and local government (\$21.7 billion), Medicare (\$3.1 billion), and other Federal government (\$2.8 billion).

At the same time that Medicaid has increased its investment in the public mental health system, its embrace of HMOs and other managed care plans has necessitated an internal transformation from an indemnity *payer* organization to a *purchaser* of managed benefit packages. Like employers and commercial insurers, Medicaid has been attracted to the promise of more predictable costs and greater accountability offered by the plans. Posing the central question, "Are we receiving value for our dollar?," Medicaid directors have begun to work with organizations like the National Committee for Quality Assurance (NCQA) to develop meaningful and appropriate measures of plan performance. Although their main focus remains general medical care, this new approach combined with the greater investment in mental health have resulted in Medicaid directors becoming active participants in systems *governance* — formulating public mental health policy. Moreover, by contracting with private for-profit or not-for-profit managed mental health care organizations, Medicaid has also become a significant force in the *systems administration* function.

MHA directors have historically been active in all three functional areas. In most states, the long standing tradition of setting public mental health policy (governance) is the most common component of the MHA's role. MHA systems operations show greater variation from state to state, with centralized *systems administration* at one end of the continuum, and regional/local (including county-based) at the other. There is also significant variation in the extent to which the MHA assumes a direct *service provision* role. Although an ideological embrace of mainstreaming has led to a greater reliance on private (mostly non-profit) providers, some state delivery systems remain largely within the public sector, and virtually all state MHAs continue to operate a (reduced) number of public hospitals. The issue here is whether the MHA, with a history in governance, systems administration, and service provision should continue in all three roles, and if so, in what manner, with which emphases. Is this history a qualification for future continuation, or does it merely result in a resistance to necessary and worthwhile change? Furthermore, if the activities of the MHA change — or even if they do not — what is the proper role of the Medicaid agency? How ought Medicaid and the MHA work together in the future?

Organizational Mission

Mission statements are intended to help organizations think clearly about who they serve — who their customers are — and how they serve them. Public mental health directors describe their mission in terms of providing systems of care for people suffering from serious mental illnesses. With respect to their customers, there has been a change of focus over the past decade: although persons with serious mental illness were the priority, before the mid-1980s MHAs tended to assume responsibility for matters affecting the mental health of all citizens in their states, regardless of their level of disability. The narrowing of mission can, in part, be understood in the context of a changing political environment that has sought to limit the role of government. Confronted with dimin-

ishing resources and the fact that many citizens have access to some insurance coverage, at least for episodic care, the MHA came to focus its resources on adults with serious mental illness and children and adolescents with serious emotional disturbance. Most mental health directors see this as a positive shift that affirms a long standing commitment to the most vulnerable groups of citizens. It simultaneously releases them from an inherently frustrating charge to "be all things to all people." During this period, many states developed specific legislative mandates which in effect determined (limited) eligibility for services funded by the MHA.

While the 'who we serve' aspect of the MHA's mission has narrowed, thinking about 'how we serve' has been expanding. With the downsizing of state operated institutions, the locus of care is shifting to community-based systems of care. The ability to understand the continuing care needs of vulnerable populations and to plan, design, and monitor innovative and responsive services is considered an area of MHA competence. Mental Health directors note that they developed many of the creative elements of a fully developed continuum of care, including intensive case management, rehabilitation services, mobile crisis teams, and diversionary services. As part of their development of community-based systems, MHAs have increasingly looked to the private sector for provision of care. While there is significant variability from state to state, all MHAs now have a mix of public and private providers in their service networks.

Medicaid directors describe their mission differently, as providing comprehensive health insurance benefits for poor and disabled citizens. Following an era of runaway growth, there is also a clear mandate for Medicaid directors to contain costs. They have increasingly turned to managed care, with its promise of cost savings and improved quality, as the most viable solution. In 1993, 8% of the Medicaid population was enrolled in a managed care plan; by 1996 that figure had grown to roughly 40%. In contrast to MHAs, the trend with Medicaid programs has been toward expanded coverage. Although Medicaid has not, as the "insurer for the poor," provided coverage to all citizens at or below the Federal poverty level, several state Medicaid Agencies have taken a leading role in attempting to address the national problem of more than 40 million uninsured individuals. These states have sought to use savings from their managed care initiatives to fund new eligibility criteria that now include persons meeting ever higher percentages of the Federal poverty level guidelines.

The move toward managed care has also had profound implications for the manner in which Medicaid agencies operate. As an indemnity insurance entity, they previously focused on claims administration and regulations regarding provider clinical and administrative qualifications and practices. In a fee-for-service environment, financial management was accomplished principally through pricing mechanisms that more often than not set provider reimbursement at below-market rates. Under a managed care approach, Medicaid agencies now strive to redefine themselves as value purchasers of benefit plans for their enrolled populations. The emphasis now is on contracting with managed care

plans, including HMOs, often on a pre-paid basis. Medicaid staff have been at the forefront in developing contract management skills and using vendor management as a primary vehicle for program implementation.

While both the MHA and the Medicaid agency are units of government, and thus ultimately share a common purpose to improve the welfare of the greater society, different missions, multiple agendas, and differing priorities can contribute to different visions of what constitutes the best public mental health policy. The mandate for Medicaid to control costs is an area of tension in many states. In situations where interagency relationships are less than optimal, MHA directors are skeptical about the stated purpose of managed care initiatives, believing that 'expanded access' and 'improved quality' are secondary to saving money. Carrying the concerns of primary consumers and advocates, they worry that the cuts in spending are too deep. For their part, Medicaid directors question the MHA's commitment to sound management, particularly when it comes to spending Medicaid funds for which the MHA is not held directly accountable.

Eligible Populations

MHAs primarily use diagnostic and functional criteria to determine eligibility for services. Because the MHA has statutory responsibility to assure emergency services for all citizens, eligibility determination has ordinarily come to mean eligibility for an array of continuing care services, such as case management or residential rehabilitation. Many adults with a serious mental illness and children/adolescents with a serious emotional disturbance who are identified as priority clients by the MHA also meet disability criteria used by the Social Security Administration for determining eligibility for Supplemental Security Income (SSI). The Federal government has defined standards for SSI that are used by the states. In addition to functional status, financial criteria, which vary significantly from state to state, are also used to determine Medicaid (and SSI) eligibility. For those clients who meet MHA criteria for service eligibility but are not Medicaid eligible, i.e., whose income and assets exceed the limits set by their particular state, the MHA is the payer of last resort, providing the safety net for this population.

While from the MHA perspective there is almost complete overlap between MHA priority clients and persons eligible for Medicaid, adults with serious mental illness and children with serious emotional disturbance are only a small percentage of the total Medicaid population. Medicaid provides coverage for two broad categories of assistance: those classified as Aged, Blind, and Disabled (ABD), and those qualifying for Aid to Families with Dependent Children (AFDC). Roughly 27% of the total Medicaid population fall into the ABD category, and less than half this group suffer from a psychiatric disability. Within these categories, Medicaid is responsible for several high risk populations that tend to be significant users of mental health services, including persons with developmental disabilities, persons with addictive disorders, and children suffering from

neglect and abuse. The majority of Medicaid-reimbursed mental health services are consumed by recipients in the AFDC categories. However, penetration rates (i.e., the percentage of eligibles who actually use services) and per capita expenditures are much higher for ABD recipients. Under a managed care approach, this sub-group is an obvious target for cost savings, potentially providing the greatest return on a per-case basis.

The fact that there are significant populations eligible for services from both Medicaid and the MHA, but also important groups that are not shared, creates opportunities for both interagency conflict and collaboration. From the MHA perspective, Medicaid funding has become a critical financing element for the *entire* public system. Decisions by Medicaid directors to award contracts to HMOs or managed behavioral health care organizations are seen by the MHA as a potential threat to the very existence of the public delivery system that must serve as the safety net for the uninsured consumer. However, to the extent that Medicaid is able to expand coverage to the working poor and uninsured (i.e. the safety net populations), additional Federal revenues may become available to allay MHA financial concerns.

The volatility of Medicaid coverage is a complicating factor for interagency collaboration. To remain eligible, Medicaid recipients must follow through with regular re-determination procedures; failure to do so results in termination of coverage. While coverage may be reinstated, even retroactively, if it is terminated for a period of time, the MHA must act as the safety net and assume responsibility for services. Changing numbers of eligible users of services makes planning difficult for the MHA, and can result in unexpected demands on scarce resources.

The perceived inability of MHA directors to specify exactly how many people they serve and how much service they receive also makes joint Medicaid-MHA planning a challenge. Because it is part of a national insurance program and must meet relatively rigorous Federal information requirements, the single state Medicaid agency has years of experience maintaining an accurate, standardized eligibility database — a prerequisite for developing risk-based managed care programs. Most MHAs have no such experience. As their mission requires them to make services available to all persons in need, they have not traditionally thought of eligibility in terms of insurance coverage. Furthermore, MHAs have not had an oversight agency such as the Health Care Finance Administration (HCFA) driving (and funding) the development of their information systems, which largely remain inadequate. Finally, although criteria may be well defined, in practice eligibility based upon diagnosis and functioning can raise serious questions regarding inter-rater reliability. The 'messiness' associated with MHA eligibility can thwart interagency efforts to integrate services through a blended funds approach. MHA directors, unlike their Medicaid counterparts, do not ordinarily think in terms of per capita spending, because they are never certain either about the size of the beneficiary pool, or what percent of eligibles actually utilize services — but these are precisely the types of analyses necessary for developing actuarially sound rates.

Covered Services

In a public sector managed care initiative, the issue of which services are to be included in the benefit is obviously a critical design decision, one which presents opportunities for interagency collaboration or conflict. If in their respective approaches to covered populations, Medicaid's mission has been relatively expansionary and the MHA's more restrictive, the opposite seems to have been true regarding mental health benefits. MHA directors have led efforts to expand the scope of services and the continuum of care for persons with serious mental illness. Unlike their Medicaid colleagues, MHA directors have not historically thought in terms of limiting benefits. Rather, they have been actively involved in creating new service models and expanding the community-based continuum. The concept of 'wraparound' services perhaps best exemplifies the MHA approach: providers are encouraged to work directly with consumers, to be creative and flexible — to use services not traditionally considered mental health if necessary. The emphasis is on doing whatever it takes to meet the needs of the client.

As a national insurance program, Medicaid is required to take a more conservative approach to covered services, and is based largely upon a medical model. Indeed, one of the chief and explicitly stated goals of Medicaid managed mental health care initiatives to date has been to bring greater flexibility to the use of Medicaid funds by expanding the range of covered services. Title XIX mandates a standard benefit, after which states have considerable leeway over final benefit design. Mandatory Medicaid mental health benefits include standard inpatient¹ and outpatient services for adults, and a somewhat broader range of EPSDT (Early Periodic Screening, Detection and Treatment) services for children. States vary in their use of optional benefits, which may include targeted case management, clinic, and rehabilitation services. In states with a broad Medicaid mental health benefit, the optional services have been added to the state Medicaid Plan in the last decade, typically as part of an interagency revenue maximization initiative.

One of the main challenges regarding managed care design facing both MHA and Medicaid managers lies in clarifying responsibility for managing and financing a comprehensive benefit package. Medicaid is more likely than the MHA to express concerns about the inappropriate use of its funds to pay for services that do not fit strict definitions of medical necessity. In one state, an explicit objective of the managed care initiative is to curb the excessive use of residential treatment for adolescents for social (i.e., protective) rather than for clinical reasons. Medicaid, the state purchaser, wants managed care organizations to develop step-down alternatives to residential care. Besides 'inappropriate' use of the Medicaid benefit, there are other related and non-medical services needed to complete the continuum. In designing comprehensive services for

¹ Mandatory Medicaid inpatient benefits do not include services rendered in so-called Institutions for Mental Diseases (IMD), i.e., hospitals in which over 50% of the residents are mental health consumers. IMD services are an optional benefit for children and adolescents under the age of 21.

persons with serious mental illness, MHA directors have recognized the necessity of providing housing supports, employment training, and other non-clinical services. While there may be consensus between the MHA and Medicaid as to the value and necessity of these non-medical services, there often are questions about service definition as well as funding responsibility.

The different properties of the Medicaid covered services can also be a complicating factor for interagency relations regarding managed care design. Medicaid has two types of covered services: the basic or mandatory services which cover acute needs, and the additional, more comprehensive optional services, which generally target continuing or long term care. The former are funded completely out of the Medicaid budget; the latter, however, are not and states often use the MHA budget to supply the state matching funds, while the single state Medicaid agency draws down the Federal financial participation (FFP). In states where Medicaid has taken the lead in developing a statewide carve out program, the basic benefit has included only the mandatory Medicaid services; management of the continuing care benefit has remained the province of the state or county MHA. The challenge for both agencies in this design thus becomes one of coordinating benefits to make the system as seamless as possible. One state placed all Medicaid and MHA services (including the state hospital) under the benefit to be administered by a single, statewide managed care organization, thereby hoping to avoid the potential vicissitudes involved with benefit coordination across agencies — the managed care organization is the single, accountable entity responsible for both acute and continuing care benefits.

Network Providers

Except in those states where the provider network is predominantly state- or county-operated, both Medicaid and the MHA tend to have separate contracts or agreements with many of the same community-based direct services providers. The nature of their provider relationships are quite different, however. Where the MHA tends to buy whole programs, often on a cost reimbursement basis, Medicaid pays for services as needed, exclusively on a fee-for-service basis. The MHA approach is generally to make estimates of needed service capacity and to then purchase accordingly, while Medicaid typically allows the participation of any and all interested providers, as long as they demonstrate the ability to meet regulatory requirements and/or credentialing standards. Thus the MHA may, for example, cover the fixed costs associated with maintaining 24-hour emergency response services (and thereby purchase “excess” capacity), while Medicaid will act as a marginal payer, reimbursing only for services rendered.

Perhaps the most important difference between these co-financers of the public mental health system lies in their attitude toward providers. The MHA tends to view community-based provider organizations as extensions of themselves; their missions are congruent, and the MHA is usually the dominant customer. Senior MHA managers often

have been providers themselves, adding to the affinity between these entities. While MHA directors may feel that they have developed and nurtured the provider system in their own image, Medicaid's provider relationships, including those with its mental health providers, have been more formal, business-like, at arms length. Medicaid directors are less concerned about the consequences of using a free market approach when they control the managed care design, perhaps, in part, because they do not view the provider system as their own.

The issue of free market versus protectionism relative to the 'traditional provider' is undoubtedly one of the more contentious areas of debate in the era of managed care. Political fault lines are readily observable when a for-profit managed care company is thrown into the mix. In its extreme forms, the rhetoric is characterized as pitting greedy corporate executives lacking experience with adults with serious mental illness or children with serious emotional disturbance versus committed, altruistic, clinically superior providers (the provider/advocate perspective) — or as pitting efficient, quality-oriented data-driven managers versus well meaning but inefficient, technologically-challenged, politically entrenched monopolists (the for-profit managed care organization perspective). Conflict is not inevitable; there are many creative compromises available in terms of network development. In some states, for example, equity partnerships between traditional providers and a private, for-profit managed behavioral health care organization are seen as a vehicle for improving network efficiency while maintaining continuity of mission. The point is that the MHA tends to experience a strong pull to advocate for partnership with the community-based provider industry, while the Medicaid agency usually does not. To the extent that providers are well organized politically and are perceived to be competent and to hold the high ground as consumer advocates, they can become a significant ally for the MHA. Policy makers in one state credit the support of the providers, as well as consumers and advocates, for swaying the administration away from the original Medicaid-sponsored carve-in design toward the MHA-proposed carve-out.

Quality Management and Approach to Customer Service

In theory, quality management represents an area of systems administration that may afford Medicaid and the MHA some of the best opportunities for collaboration: all parties can agree that improving quality is an important and worthwhile goal. The two agencies have somewhat complimentary strengths in their approaches to quality. As with network providers, it is safe to say that the MHA has historically been closer to the ultimate customer of the public mental health system, the consumer of services. As a provider and a systems manager, the MHA has had more direct experience meeting the needs of its clients than has Medicaid, the insurance organization. The nascent consumer empowerment movement has been consistently supported by MHA directors across the country, many of whom have established offices of consumer affairs within the office of the director.

In recent years, the concept of involving consumers, not only in their own treatment planning and delivery, but also in systems design and governance, has gained wider acceptance. Even where Medicaid and MHA relations have been strained, Medicaid has accepted the wisdom of emphasizing consumer rights, grievance and appeals processes, and consumer participation in policy development as part of its procurement specifications.

Medicaid's approach to quality management, consistent with trends in the managed care industry, has been to establish systems for measuring and monitoring plan performance. Medicaid directors have displayed leadership at the national level through their work with NCQA to adapt HEDIS (Health Plan Employer Data and Information Set) for their covered populations. MHA directors have also been eager to support the emphasis on creating meaningful, manageable, data-driven performance indicators, working with the Federal government in the creation of the Mental Health Statistics Improvement Program's (MHSIP) Consumer-Oriented Report Card. Both agencies share a common desire to institute provider profiling on a regular basis, although neither has yet demonstrated the technical capacity to implement such systems. Medicaid was the first to point out the advantages of procuring private sector technological capabilities in the service of quality management; the MHAs, although at times skeptical as to the merit of marketing claims by managed care organizations regarding their capabilities, have largely agreed.

Other Considerations: Structure and 'Turf'

There are several other factors unrelated to history, mission or operating style that appear to have an impact on interagency relations. These include the place of each agency within the governmental structure; the history of working relationships between agencies; and the ambitions, credibility, and public management skills of the agency head. Surprisingly, it is difficult to discern any trends with respect to where each agency is housed in the administration. For example, in some states, the two agencies have historically been in different cabinet level Departments. Such separation may create a distance that makes interagency dialogue more difficult, and interferes with coordinated policy making. By the same token, considerable tension can occur in managed mental health care initiatives, even when both organizations are housed within the same Secretariat. Yet, a history of solid interagency working relationships does not, as one might suppose, automatically lead to collaboration on specific managed care initiatives. In some states, good long-term relations coupled with the intimacy of a small state government, have facilitated that state's blended funds approach; in others, however, good working relationships at the staff level ultimately proved powerless against strong differences in vision and style between agency heads.

The permutations associated with locally-based MHAs, specifically the balance of power and responsibility between the state and local- and county-level MHAs, is yet another complicating factor in terms of designing and implementing a managed care

initiative. From the Medicaid perspective, it is logistically easier to deal with a single agency than with multiple governmental organizations, particularly when the task is one of clarifying complex management and financing roles and responsibilities. In states with a strong tradition of county government, the local MHA is a major funding source, and thus a key player in the administration of the public mental health system. In one state, tensions between the state and county MHAs led to a scaling back from the original, ambitious plan to expand coverage and blend all funding streams on a regional level through competitively procured, at-risk managed behavioral health care organizations, to a more modest proposal to hire a single organization to manage the acute Medicaid benefit on an administrative services only basis. The state's Medicaid agency was relieved to be able to delegate governance responsibility to the state MHA. Medicaid concerns regarding MHA systems management capabilities are also exacerbated when dealing with an array of county administrations that vary in size, population density, culture and systems capacity. Economies of scale for supporting a managed care infrastructure are an issue, particularly for smaller counties: multi-million dollar investments in management information systems development and staff training, for example, are less attractive when they spread over revenues generated by smaller risk pools. Finally, there are legitimate questions as to whether counties can or should bear financial/insurance risk, and thus a number of states have encouraged (or insisted upon) partnerships with private for-profit or not-for-profit managed behavioral health care organizations.

History and structure may determine the context in which individual public sector managers operate, but the agendas and leadership skills which they bring to bear seem to be the most important factors in determining interagency dynamics, that is, whether Medicaid or the MHA will assume a dominant role, or whether they will act as equal partners. During the initial planning process for the carve-out initiative, one state's MHA offered to serve as the managed care entity itself, and expressed an interest in assuming financial risk for the Medicaid premium. The Medicaid agency declined the offer because: (a) they believed that a private company would be less subject to political pressures in the course of system reform and network reduction, and (b) they did not have confidence in the MHA's administrative systems. In the face of a budget crisis, the Medicaid director was able effectively to enlist support for the Medicaid proposal from both political parties, as well as from the community-based providers. The Medicaid agency thus assumed control of the managed care planning and implementation process. Since then, both agencies have recognized the value of partnership, and staff from both have made great efforts at collaboration, significantly improving interagency dynamics. In the second generation of the program, the MHA has contributed financially to the program, and has (re)gained an expanded policy role.

In another state, which has enjoyed a history of good working relationships at the senior staff level, a planning process for joint, cooperative purchase of managed care services under a carve-out model was replaced in favor of the current carve-in plan. This

change was implemented by a new Department Secretary responsible for administration of the Medicaid program. A former HMO executive and a forceful proponent of integrating primary and mental health care, he was successful in winning the confidence of the key decision maker — the popular Republican Governor. A swift, well executed campaign carried the new design over the belated protests of providers and the Democratic legislature, while the MHA was caught in the middle.

A skilled and credible public sector manager can have a significant impact on the relationship between the MHA and the Medicaid agency. In one case, the MHA director mobilized key constituents to support the MHA in its efforts to retain control of an administrative services only carve-out design. The design debate covered the usual advantages of integration versus specialty care, with Medicaid urging coordination of primary and mental health care and the MHA emphasizing the unique skills and experience of the existing community-based system. Ultimately, the Governor was convinced that the MHA had the vision and competence to successfully administer the program. In the ensuing carve-out, Medicaid funds are run through the MHA, which administers an administrative services only contract with the managed behavioral health care organization.

Considerations for Public Managers

Whether they like it or not, Medicaid and the MHA are partners; together they share responsibility for the well being of vulnerable populations. As states look to managed care programs to improve their public mental health care systems, the challenge facing both Medicaid and the MHA is to find ways to overcome historic differences and develop new methods of collaborative governance and systems administration. These agencies have made significant investments of both financial and intellectual capital in the public mental health system. Despite differences in emphasis and operating styles, they ultimately share a common mission. They both seek to create systems of care that are less reliant on inpatient services and place greater emphasis on primary and preventive services. They both seek to create rational management structures supported by a solid informational infrastructure. Finally, they both seek to make the best use of limited public resources. To achieve these mutual goals, public managers may consider the following steps:

Develop structures and processes to support ongoing interagency dialogue. Regular communication is an obvious and critical element for effective collaboration. Managers must determine the formal agendas and frequency of interagency meetings at both senior and middle management levels.

Identify priority areas for systems improvement. A collaborative, systematic review of all functional areas should probably be the first agenda item for interagency discussion. Managers will want to assess current eligibility criteria and member services; covered benefits; the status of the provider network and network management procedures, including gaps and areas of duplication; utilization review and management procedures;

quality management processes; management information systems and reporting capabilities; and system financing. Such a review should be comprehensive and should incorporate the activities of both agencies.

Identify strengths, weaknesses, and areas of competence, for each agency. In addition to identifying the highest priority goals for systems-level reform and improvement, the interagency review should also explore the core competencies of each agency. The goal is to work as a team, building upon current capacity and taking advantage of complimentary strengths.

Develop an interagency action plan. The end product of interagency review activities should be a jointly published vision for system reform, including priority goals and the steps necessary to achieve them. It is important to clarify the roles and responsibilities to be assumed by each agency, particularly the manner in which they are to manage and facilitate the participation of key stakeholders.

Develop meaningful, manageable measures of systems-level performance. Any plan of action that results from an in-depth interagency systems review must include systems-level (as opposed to individual client- or provider-level) performance indicators. A major challenge for the agencies will be to come to agreement on how to measure success.

The use of public funds to purchase managed care programs for consumers of mental health services is a relatively new phenomenon. Responding to varying histories and arrangements regarding Medicaid and MHA funding and functioning, different states have launched a series of unique experiments. A number of important issues are still being actively debated: which populations can or should be managed under the same plan; whether use of a specialty mental health benefits management (carve-out) organization is preferable to an integrated approach; what is the legitimate role of the profit motive in the management and delivery of services. In an environment that has heightened expectations for accountability and cost control, state policy makers are particularly challenged to coordinate and optimize the use of limited resources. Although we currently lack empirical evidence, we suspect that interagency antagonism results in less than optimal service system quality and efficiency and that interagency collaboration is critical to successful system reform.

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Public Sector Purchasing of Managed Behavioral Health Care

**Colette Croze, John Allen, Tom Barrett, Ron Copeland, Robert Egnew,
Marilyn J. Henderson, Ronald W. Manderscheid, Candace Nardini,
Eleanor Owen, Darby Penney, Laura Van Tosh, Ivan Walks**

The Current Governmental Environment

As is true for all governmental functions, publicly-sponsored mental health services are experiencing transition and transformation as state and local public officials re-examine the role of government and its responsibility for vulnerable populations and human services. Additionally, as government continuously attempts to balance its priorities across health care, education, corrections and tax relief, cost control and containment take center stage as considerations underlying policy decisions. In the absence of Congressional action on national health care, both the commercial sector and public payers are demanding significant changes in providers' attention to quality and cost. Increasingly, public payers are adopting commercial strategies for managing limited resources in health and human service systems care and sharing financial risk¹ with private enterprise.

Whether in response to Medicaid reform, or as a continuation of service improvement efforts, a growing number of public mental health systems have been dramatically affected by states' initiation of managed care, particularly where the single state Medicaid agency played a major role. Funding methods, eligibility requirements, benefit packages, and management structures have frequently all been modified as Medicaid agencies moved to purchase coverage for beneficiaries through managed care plans. Public systems have also been re-shaped as previously-funded not-for-profit providers either assumed significantly expanded or reduced public sector roles or developed new forms of public/private partnerships to gain competitive advantage in changing public markets.

Even more significant than the incorporation of managed care strategies into public mental health systems is the use of risk sharing arrangements between government and private organizations which allow government to transfer to or share financial risk with

¹ While there are various forms of risk contracts, they share the characteristic that contractors under these arrangements receive predetermined, advance payments that cover either a specific benefit package for a group of beneficiaries or a negotiated set of management functions.

managed care organizations. While early forms of care management were overlaid on reimbursement-based (fee-for-service) financing systems, current strategies for managing care and costs attempt simultaneously to rationalize clinical practice and create financial incentives for care managers and providers to offer only the services that are necessary to restore or improve health status.

Pressures for Public System Action

The current wave of public sector managed mental health care initiatives follows on the heels of both state-based health care reform and Medicaid cost containment. Many states are still enacting legislation making broad-based changes in both public and private health insurance systems; the public mental health system is often swept along with the reform tide towards risk-based managed care. Several Governors have been forced to make wide-sweeping and precipitous changes in their public health and mental health systems in response to serious and sometimes sudden funding problems. Medicaid has aggressively embraced commercial models of risk and care management for its beneficiaries and gives every indication of continuing this trend. Through these arrangements, Medicaid can predict and control its future financial liability by sharing or transferring financial risk to health plans. Numerous state mental health agencies (MHAs) have had to consider risk-based managed care in order to follow Medicaid's lead in adopting more insurance-like purchasing strategies. When one strong state-based purchaser is so clear about future directions, other components of state government must often follow along. Like Medicaid, the state MHA has experienced fiscal pressures that have driven it to new financing methods and risk arrangements; and, in response to actions by their state's Medicaid agency, several state MHAs have been forced to move to risk-based contracting to slow the rate of growth in Medicaid spending for mental health services or to counteract the effect of other policy decisions, such as deregulation of hospital-based services. There are other reasons for change: some states, like Ohio, have developed their managed behavioral health plans as system improvement initiatives and public stakeholders have often pushed for system reform through managed care efforts.

There is also renewed interest in privatization of government functions. With public opinion solidly in support of less, not more, government, many states and counties are feverishly streamlining through reorganization and "right-sizing." Often these efforts result in downsizing and shifting of government responsibilities to private sector auspices. Moving to risk-based managed care offers government one more opportunity to transfer responsibilities to the private sector. The public mental health system's conversion is often just a small piece of states' and counties' larger efforts to divest themselves of various health care and human services functions. Privatization of child welfare services, privately-operated correctional facilities and provision of prison mental health

services by managed behavioral health care organizations — all are examples of government's efforts to outsource functions that were previously governmental responsibilities. In current outsourcing efforts, today's government contractor is as likely to be for-profit as tax-exempt.

The final external source of pressure for risk-based managed mental health care comes from the managed behavioral health care organizations themselves. With more than one hundred sixty million insured Americans enrolled, understanding that they have saturated the commercial market, these firms are aggressively pursuing public sector business. Managed care organizations and other for-profit industries (for example, enterprises like Lockheed that once thrived on defense contracts) are now very interested in the public sector and often create political pressure to promote further privatization.

There are also fiscal and programmatic reasons internal to public mental health systems that make prepaid, risk-based financing an attractive alternative to current methods. When the public mental health system itself has advocated for the move to managed care, the primary reason has been the desire for more flexible funding in support of community-based, recovery-oriented services and supports. Prepaid arrangements allow the payer to control its financial risk and reinforce accountability while it offers the purchaser/care manager broad clinical flexibility. With financial liabilities controlled and with attention paid to performance standards and outcomes, public payers can transition from fee-for-service Medicaid with its often rigid categories of services and reimbursement methods. Paying for coverage of beneficiaries through mental health plans also provides the MHA the opportunity to finance systems of care, rather than individual providers or services. If risk arrangements are structured correctly and, if the public payer shifts from "monitoring" to rewarding and sanctioning performance, prepaid managed mental health plans can create incentives for outcome-producing, consumer-sensitive services. With capitated plans and with at least intermediate-length contracts, the MHA can proactively arrange the interventions and systems of care for plan members; it can begin to turn providers' attention to relapse prevention, recovery and well-being as outcomes for public consumers.

A thoughtful assessment of risks and opportunities should occur before the MHA embraces or rejects managed care. This does not refer to the financial risk analysis conducted by actuaries, but rather, the risk associated with either changing the public system or supporting the *status quo*. Although the *status quo* may seem comfortable, there are almost always improvements to be made in public systems, and risk-based managed care can facilitate some or many of those changes. Grant-based or fee-for-service reimbursement does not establish responsibility for a population of enrollees, nor facilitate either the development of systems of care or prevention-oriented interventions. Absent clear accountability for an identified group of beneficiaries, systems can neither manage care nor produce long-term positive results. Public MHAs may be seen as being captives of their constituencies and shirking their public stewardship respon-

sibilities if they refuse to move assertively into the future. Credibility could be lost by the public mental health system if it is seen as resisting system re-engineering in the face of needed revisions.

On the other hand, all the current rules of the game change with the initiation of managed mental health care. Risk transfer signals problems for not-for-profit public community MHAs who have operated in government-regulated environments with significant financial and programmatic constraints not felt by for-profit organizations. Providers will often resist the move to risk-based managed care because of the financial pressures it places on their organizations (e.g., solvency requirements, risk reserves, etc.) and the increased management demands it creates. Other stakeholders are often wary of the value of abandoning a known public mental health system for the potential, but uncertain, benefits of new financing arrangements that will most certainly change clinical practice. Public MHAs are often ambivalent about large-scale system change and may feel that they do not need to fix something that is not broken. In either case, the MHA must carefully consider the choices and consequences of either reinventing or reinforcing its existing public system of care.

Considerations for Public Sector Decision Makers

As public systems consider a move to risk-based managed behavioral health care, they would be wise to formally assess the risks and opportunities presented by such a venture. The following questions could guide such an assessment:

How does this state or local government define the "public interest"? What is government's role within its definition of the public interest?

Each state and local governmental must define for itself the public interest as it relates to behavioral health services, government's provision of those services, and the roles of the public and private sector in the delivery of care. A public mental health payer developing its blueprint for managed care should use its system's definition of the public interest to frame its policy choices. These policy choices should guide decisions about what roles and responsibilities government retains, what functions it privatizes, and how it structures the relationship between governance, management, and service delivery.

What is the political climate of the state or local government? Are elected officials for or against changes in governmental operations? Is there positive or negative sentiment towards government "right-sizing" or "downsizing"? Are other parts of state or local government considering, planning or implementing risk-based managed care contracting?

In public mental health systems where elected officials believe that government's presence in direct operations should decrease, the MHA may need to consider a structural model in which some or most managed care functions are privatized. Conversely,

if public sentiment supports more government, the MHA might retain a stronger role, especially if it positively assesses its ability to carry out those roles competently. Likewise, when other parts of state or local government have set some precedents for adoption of managed care technologies, the MHA may need to adjust its approaches so that they are compatible with those public payers' techniques.

What is the current assessment of the "state of affairs" in the public mental health system? Good, bad or something in between? Is there need for system change and/or improvement in the system and its services?

Public mental health systems should conduct an honest evaluation of their system's functioning and capacities as they consider a move to managed care. At this stage in system assessment, recipients' input is critically important. With accurate information on system performance, MHAs can maximize the potential positive results of risk-based managed care by incorporating specific quality improvement goals into their managed care plans and by operationalizing those goals through the functional and structural design choices they make.

What is the basis for the problems in the public system? How might they be addressed through at-risk managed care? What are the system's existing strengths? How can they be enhanced? Can risk-based managed care reinforce the good points (and accelerate their system-wide adoption) while it addresses sometimes long-standing and intractable problems?

Having identified the nature and scope of the problems in its system, the MHA should tailor its structural design, assignment of functions, and purchasing specifications to address these problems. For example, an MHA that determined that hospitalization was being over-utilized could structure its risk sharing arrangements to incentivize community alternatives. Similarly, an MHA that assessed its existing contractors (either governmental or not-for-profit) as being unable to assume a robust level of risk transfer, might phase in risk sharing over time by moving from performance risk to underwriting risk.² Alternatively, the MHA might encourage partnerships between its provider community and "managed care competent" managed behavioral health care organizations.

What are the advantages of moving to risk-based managed care contracting? What are the disadvantages?

Incorporation of entirely new financial and clinical risk management approaches will necessarily create significant movement in a public mental health system; this movement may be required in order to develop recipient-responsive, outcome-oriented services. The MHA must balance the need for change against the potential impacts of that change as it develops a managed mental health care plan.

² Contracts that transfer underwriting risk require the vendor to insure the beneficiaries whose care it manages by covering the costs for all medically necessary services; performance risk contracts hold the vendor financially liable for its performance, but not for all costs of services.

What relationship will be structured among various funding streams? How will public insurance programs (i.e., Medicaid) interact with safety net services?

Although most public payers do not develop a seamless plan for Medicaid and “non-Medicaid” funding, some attention should be given to the interaction among Medicaid, state general revenue and local funding since they purchase different components of the public mental health system. Because service recipients’ Medicaid eligibility changes over time and non-Medicaid funds pay for services for Medicaid recipients, a coordinated plan for the use of public behavioral health funds could facilitate continuity of care and improved outcomes for service recipients.

What are the risks associated with moving in this direction? Will providers revolt? Will consumers and families be apprehensive? What are the risks associated with no movement? Will Medicaid make the decisions? Will the public MHA lose credibility with inaction?

The risks accompanying either action or inaction must be strategically evaluated. While the MHA may lose significant political support, for example, by implementing managed care against its providers’ wishes, it may also risk diminished power within government if it resists an inevitable move toward privatization through managed care. There are more than a few states in which inaction on the State MHA’s part provided the State Medicaid agency with the opportunity to assume control of mental health policy decisions.

Does the public MHA have the authority, responsibility and skills to undertake this level of system change? If it does not, how can it acquire them?

Development and implementation of a public sector managed behavioral health care plan is more than a notion; it requires both strong technical skills and knowledge as well as a savvy political strategy and a targeted approach to issues management. Construction of the benefit package, articulation of quality management requirements, selection of risk sharing arrangements that support specific clinical and financial objectives, competitive procurement and negotiation of multi-million dollar contracts—these are new activities for MHAs. The challenge of competently performing these functions should not be taken lightly. Public MHAs need to assure that staff who are asked to assume these challenges have the ability and technical support to become “smart buyers” of public sector “goods and services.”

What is the lay of the land/division of labor between either the state and counties or the state and not-for-profit providers? How politically powerful are the not-for-profit community MHAs? What political strategies will facilitate systems change?

Public MHAs should never underestimate the system’s resistance to change as it attempts to maintain the best components of its old public system and provide new opportunities for incorporation of more effective clinical care and financial management. The MHA must conduct an environmental scan of the political forces as it simultaneously

crafts productive, successful roles for its traditional providers and systems managers. Implementation of public sector managed care must be treated as both a quality improvement effort and a political campaign.

Participants in Policy Deliberations and Decision Making

Public mental health systems have an increasingly strong history of offering stakeholders broad opportunities to comment on and influence policy and budgetary directions. As public systems define them, stakeholders include service recipients, families, advocates and providers as well. Less frequently do MHAs actively incorporate taxpayers, governmental colleagues and “non-mental health” community institutions in their planning. Nevertheless, broad-based input has been the norm rather than the exception in public mental health for the last ten years.

When public bodies like state and local MHAs make policy and budget decisions, stakeholders expect to play an active part and to be integrally involved in all aspects of benefit and structural design. While broad-based input is critically important, a distinction must be made between participating in policy deliberations and participating in the decision-making process itself. The two are not interchangeable, although each is often mistaken for the other in public mental health policy development. Public MHAs need to solicit opinion on managed mental health care design broadly and widely, with overrepresentation of consumers and families of minor children, but then they may need to work within an entirely different policy environment in negotiating the design decisions.

In the development of managed mental health programs, the MHA does not always control the process or the decision-making. For example, while the MHA may have lead *design* responsibility, it may not have final *decision-making* authority; the designers, then may not be the decision-makers. To be fair to stakeholders, the MHA needs to make this clear so that everyone understands that the MHA may be required to move between a very open “design process” and a more narrowly constrained “decision-making process” in which it negotiates, not makes, the final decisions. It may be that the state Medicaid agency, the Governor’s Office or a legislative appropriations committee has final decision-making authority. A delicate balance must be struck between encouraging broad stakeholder input and making that input meaningful. The MHA must inform its constituencies about which issues it is managing and which decisions will be made in another part of the executive or legislative branch of government so that stakeholder input can also occur there.

To date, one of the major areas of contention in managed mental health care development has been the division of labor and power between the State Medicaid agency and the State MHA. In numerous states, the Medicaid agency has chosen the mental health benefit design, sometimes without any input from the MHA. In a few states, the

MHA has taken the lead on benefit design and in a few more states there has been collaborative development of the managed mental health care initiative. Oftentimes, the degree of unanimity or dissension within the mental health community has determined whether the State MHA or the Medicaid agency was the final arbiter of public policy on managed mental health care design.

Impact of the Decision to Initiate Risk-Based Managed Care

In states where either the Medicaid agency or the State MHA has decided to embark on the path to managed mental health care, a series of activities surround this decision. First, a political strategy must be chosen to complement the technical plan for managed care; something akin to a political campaign is often required to move an agenda of system change forward. Assuming that the public payer has settled on its benefit design (including a quantifiable description of beneficiaries, definition of the benefit package or service array, and identification of funds to support both), it must also make choices on structural design: who will perform which functions in a managed mental health care system? Choices on structural design are typically based on the public mental health system's specific managed care objectives as well as on its identification of the required care management capacities and an evaluation as to where the MHA can find those capacities.

There are three fundamental roles within health care benefits administration and management: the *payer or sponsor* who administers a mental health benefit and pays someone to manage that benefit; the *purchaser or care manager* who manages care and purchases individual, discrete services on behalf of beneficiaries; and *providers* who deliver the clinical care. After deciding who the beneficiaries are and what the benefit package will be, the MHA must then decide which types of organizations will perform each of the three fundamental roles. The MHA is always the payer or sponsor and public providers will almost always form the clinical core of any managed system of care. The role which is most hotly contested in public mental health care is that of the purchaser or care manager.

Although State Medicaid agencies typically use commercial models for care management and contract with HMOs or integrated delivery systems, MHAs usually spend considerable time choosing the "structural" model for their managed systems of care. This is not surprising, given the public system's history of creating and nurturing mental health-specific infrastructures, usually by delegating authority to local government or by granting operating franchises to not-for-profit community mental health agencies. Deciding which types of organizations will be eligible to act as the care management entity sets the future course for many components of the public mental health system and dramatically changes the roles of the MHA and its traditional providers.

Most states have invested considerable resources in either county- or not-for-profit-based administrative systems and most MHAs begin their managed care planning by

assessing the possibility of using these structures as care management entities.³ States also carefully consider the possible conflict of interest between care management and service provision and have sometimes prohibited organizations that provide treatment from also assuming the care manager role. While this decision may provide some level of consumer protection and increase consumer choices, it also means that traditional community mental health providers will not be able to perform care management roles. This is an important decision since MHAs are particularly concerned about the future role of their not-for-profit community mental health partners in an at-risk environment. Most states still fund community providers through deficit-financing or grant-based contracts. Even when “performance contracts” are used, performance is rarely tied to financial rewards or penalties. Traditional public providers, then, have had no experience in managing financial risk and have generally been able to manage clinical risk through waiting lists, ceasing services when grant funds have been exhausted, and appealing to the state or county for additional funding. With the marriage of managed care and risk-based contracting, financial and clinical objectives are aligned as the care manager is placed at risk for the delivery of “the right treatment to the right person at the right time.” In a capitated arrangement, the vendor receives a prepaid premium for every person who is enrolled in its plan, regardless of that person’s need for or receipt of service. With prepayment and responsibility to provide a medically necessary benefit for an identified group of “covered lives,” the care management entity holds clinical and financial risk for the delivery of services. While many public system providers believe they have been managing care for quite some time, in reality they have been managing global budgets, rarely managing costs, and almost never managing care consistent with industry standards for mental health. These providers must re-engineer their operations in order to assume risk in managed systems of care.

Choosing an Internal or External Agent for Risk-based Care Management

Once the MHA has identified the functions to be performed by the purchaser or care manager, it must decide where to locate these functions. There are two basic choices: to assume the care management role itself or to outsource the functions through either sole source arrangements or competitive procurement.⁴ Sole source contracts could be

³ Many MHAs have used the term “care management entity” or “managed care entity” to convey a possibly broader definition of these organizations than that implied by the use of the term “managed care organization” which is usually associated with the traditional staff model HMO or a managed behavioral health care organization.

⁴ In sole source arrangements, the MHA identifies the specific organization with which it wishes to contract without accepting competing applications or bids for award. Competitive procurements are structured to allow “open and fair competition” from a variety of applicants or bidders.

entered into with either existing players or with newly-created organizations whose sole purpose is often public sector mental health care management. Competitive procurements can be structured to allow all types of qualified organizations to bid, or can restrict eligibility to only certain types of organizations, e.g., not-for-profit entities.

There are also several methods for managing risk and for performing care management functions. Public payers can transfer all insurance (or underwriting) risk to managed care entities through fully capitated arrangements; or they can share underwriting risk through either less than full capitation or the use of stop/loss and reinsurance mechanisms.⁵ State or local government can contract for administrative services only (ASO) through contracts that share performance risk, but not insurance risk. Under these arrangements, a managed behavioral health care organization would typically process and pay claims, authorize care, credential providers, and provide data on system performance, but would not bear insurance risk for the enrolled population. Public MHAs can also “unbundle” the care management functions, contract for only a portion of them, and perform others themselves; these contracts are typically more like “pre-managed care” management contracts than managed care organization contracts.

The basic distinction in procurement methods appears to relate to the pre-managed care division of labor between the state and either local government or not-for-profit mental health organizations. Most often this choice is influenced by the statutory mandates governing public mental health administration, the payer’s satisfaction with the *status quo* and the preferences expressed by the state Medicaid agency as the other public mental health plan administrator. In states where local government has a specific and mandated role in system administration, counties and municipalities are most often given preferential treatment in managed mental health care procurements. When a state has relied on local government as its administrative agent, it typically grants those agents either the “right of first opportunity” to compete for the contract, the “right of first refusal” to accept the care management role, or affords those agents special status in the application or bidding process. In procurements where counties have been afforded the “right of first opportunity,” they are required to submit applications to demonstrate their ability to perform the managed care functions (commonly called “show qualifications”). When states use the “right of first refusal” approach, the county needs only notify the state that it is ready to assume the care management responsibilities; once the county expresses readiness, no other bidders are considered. Likewise, when not-for-profit community mental health agencies have statutorily-mandated status as preferred providers, they may expect to enjoy special consideration in a state’s managed care design. However, with one exception, all states who consider

⁵ Stop/loss and reinsurance are two methods for limiting the managed behavioral health care organization’s risk. In the first, there is a dollar limit established for the organization’s financial liability at either the individual consumer or aggregate level. In the second method, an organization would purchase insurance to “reinsure” itself against catastrophic care and service expenditures.

community mental health organizations their local agents have used a competitive process for choosing the care management entity.

In choosing the preferred organizational type to perform the care management function, states have generally taken one of two approaches: either they have built on the public system's pre-existing infrastructure or they have departed radically from the past and contracted with entirely new organizations. Of the programs currently operational, seven states have used the first method, five have proceeded with new organizations, and two are using either a combination of new and old organizations or new types of organizations that are hybrids of managed behavioral health care organizations and community mental health agencies. Public MHAs also have a policy decision to make in specifying which types of non-governmental organizations are and are not eligible bidders in these procurements. They can "privatize" care management through for-profit managed behavioral health care organizations or they can require or allow not-for-profit mental health agencies to perform these functions; to date, only Arizona has excluded for-profit organizations from applying for regional mental health care authority contracts. Although early managed mental health care contracts were predominately awarded to for-profit organizations, more recently, states have begun to incorporate managed care practices into the not-for-profit environment, either in programs that are operational (Colorado) or programs moving towards implementation (Kentucky).

In states that have purchased care management through an open competitive process, the decision appears to be influenced by a number of factors, each of which alone and in combination makes it much more likely that the state will contract with a large, for-profit managed behavioral health care organization.

Statewide design. The use of a single, statewide contract is attractive since it eliminates the need to adjust the capitation payments to account for differential risk among enrollees. The use of statewide capitation rates also allows the MHA to ignore any sub-state differences in historical Medicaid spending that were most likely driven by provider location and billing practices, not by consumer residence or need. Selection of a for-profit managed behavioral health care organization, then, allows a new, external agent to make the politically unpopular decisions to re-direct utilization, and therefore funding, in support of consumer need. The use of a single, statewide contractor is also likely to lower administrative costs as a percentage of total spending and increases the consistency of care management decisions and quality improvement approaches. The large scope of work and the requirement for substantial financial reserves makes for-profit managed behavioral health care organizations more competitive for these contracts and also decreases the likelihood that not-for-profit community mental health agencies will be able to bid.

Financial risk. If the MHA intends to fully or substantially transfer its financial risk to a managed care organization, the state may be more likely to construct its program design and structure its procurement process to allow for-profit organizations to

successfully compete. This is particularly true in states that strictly regulate both risk bearing organizations and the capacities these organizations must possess in order to legally bear risk.

Speed and scope of change. Finally, states that want speedy and/or dramatic change are likely to contract with an organization that has not been part of its traditional provider group and that, therefore, will likely provide a more objective view of the public system's strengths and weaknesses. This is particularly true in states where stakeholders view traditional providers as one of the problematic components of the system. An organization entering the public arena for the first time may be presumed to possess abilities and willingness to effect system change in ways that long-term public sector participants do not. The MHA may believe that it can accelerate the speed and scope of change only if it relies on a "foreign body" to be the agent of that change.

The Role of the Public Mental Health Agency

While there are compelling reasons for public mental health systems to move to managed care arrangements, such moves also present serious challenges, depending on which of the three primary roles the MHA performs (payer, purchaser or provider).

Almost all MHAs have continued in the service provider role and experience the typical historical struggles to maintain and improve quality care in government institutions. Since they have most often protected these institutions from participating in the managed system of care, it is difficult to assess the real impact of risk-based care management on state and county hospitals or community services. Although almost all MHAs have chosen to transfer risk to local government or outsource benefits management to private corporations, one state has accepted risk from Medicaid and contracted with an Administrative Services Organization on a performance risk-basis to manage care on its behalf (Maryland). Several other states (Vermont, for example) are developing plans in which they will perform the care management functions.

Counties present quite a different picture from states. In contrast with states, many counties are attempting to retain risk and become proficient care managers. In California, for instance, only a handful of counties have contracted with managed behavioral health care organizations, and, then, only through ASOs or "unbundled" arrangements. Similarly, in Washington State, only two county-based systems have taken the same approach. (It should be noted, however, that neither of these states has fully capitated contracts with counties.) On the other hand, in Pennsylvania, where all risk for Medicaid mental health services has been transferred to five counties,⁶ four of the five counties have trans-

⁶ Pennsylvania is phasing in its *HealthChoices* behavioral health carve out program on a regional basis; only the Philadelphia region is operational at this time.

ferred risk to for-profit managed behavioral health care organizations. Only Philadelphia has chosen not to contract with a managed care organization; instead, it has created a not-for-profit organization to perform care management functions on its behalf.

When MHAs attempt to function as the at-risk care manager, the challenges are great. For an MHA to meet or exceed private sector's standards, it needs several critical capacities. The first one described here often presents insurmountable problems for public organizations that wish to become at-risk care managers: on line, real time information systems and information analysts who can convert data to information. The information system must support utilization management, claims payment, and encounter reporting. The MHA must also have multi-year budgeting authority to carry funds over from year to year; and it must have the ability to retain all earned revenues. The public care manager needs the personnel management flexibility to quickly hire, redeploy, and terminate staff in response to changing administrative and clinical demands.

Public MHAs have difficulty functioning as the at-risk care manager, not because there are not just as many talented people in government as in private operations, but because government has structured itself in ways that inhibit or prohibit creative, flexible, fast-paced operations. Government's appropriations, personnel and procurement processes are meant to restrict, rather than facilitate, administrators' degrees of freedom. Public MHAs are rarely able to acquire adequate resources for major information system overhauls — let alone to continue to put money into maintaining those systems once they have created them. If they do manage to find additional funds for critical human resources, position classifications, salaries, and hiring processes make it very difficult, if not impossible, to recruit and retain highly qualified information services, clinical, and administrative staff.

When MHAs choose to outsource care management functions, they must transition to the role of "smart buyer." This shift in government's role from a fiscal agent who pays fee-for-service claims (or a philanthropic organization who provides grants for deserving public agencies) to a sponsor who buys health insurance for its members, requires attention to benefit design, quality improvement, and strategic procurement. Buying clinical services and supports is very different than buying utilization management, quality improvement, and information analysis. Many MHAs have had to adopt new methods of contract management and performance measurement as they have entered into risk-sharing arrangements with care management entities.

Outsourcing Benefits Management

While MHAs are generally reluctant to turn their systems over to entirely new organizations, there are some factors that seem to increase the likelihood that outsourcing will be considered. Obviously, these forces are powerful since all states who are currently

administering carveouts have either entered into ASO contracts or fully outsourced care management.

If a public payer is seeking a high degree of system change, with broad scope and speedy implementation, it will most likely choose to outsource the care management function. The technologies, experience, and "deep pockets" required by initiatives with these characteristics make it unlikely that either public or not-for-profit organizations will be able to manage these types of programs. If the MHA wants to share or transfer risk; and, if the program's scope is large (i.e., statewide), these decisions will also drive the MHA in the direction of allowing for-profit managed behavioral health care organizations to compete for public sector business, even though few of these organizations have public sector clinical experience. Since Medicaid almost always wants to transfer risk to another entity, the MHA will need to find a risk-bearing partner (either for performance or for underwriting risk) to assist in meeting Medicaid's objective if the MHA is either unwilling or unable to accept risk. Similarly, public payers' desire to capitate to create incentives for efficiency, early intervention, flexibility, and outcomes leads to outsourcing since risk transfer requires vendors who can bear and manage risk. Currently, it appears that all MHAs will seek outside assistance in developing and maintaining managed care competent information systems. Even MHAs who intend to perform some or all of the care management functions have contracted for a substantial degree of information system support.

Government is also likely to outsource if it has a longer range vision of more aggressive human service consolidation, even if it only begins with contracting for management functions through administrative services organizations arrangements. Similarly, government may be more able to integrate services (whether this is health/behavioral health or various components of human services) through an organization that is external to governmental operations and that can mitigate the effects of "territorialism" within government. Government may need a fiscal intermediary to integrate funds from various parts of government, so that individual program focus can be maintained while efficient and coordinated service provision is encouraged.

The decision to outsource, however, does not require that the MHA contract with a for-profit managed behavioral health care organization. If the state or county can share risk with its care management entity, a not-for-profit community mental health organizations could serve as the managed care organization. In this way, the public sector could adopt strategies and techniques that were previously performed exclusively by the for-profit mental health care industry. Several recent public managed behavioral health care initiatives have allowed or encouraged partnerships between not-for-profit community providers and for-profit behavioral health care organizations (e.g., Arkansas, Kentucky).

Risk and Profits in Public Markets

Both government and not-for-profit organizations are more able to participate in a managed care design when the public payer chooses a regional or sub-state framework for system management. When either government or not-for-profit organizations are accepting risk, the MHA needs to make sure the care manager can manage the risk it accepts; several states have experienced serious problems in transferring risk to organizations who were not capable of assuming it. States who are relying on government as risk-bearing care managers have generally implemented managed mental health care at a much slower pace. County commissioners often engage in protracted deliberations on the merits and downsides of accepting risk from state governments. Because they are often the final link in the safety net, counties understand the need for their behavioral health services to assist them in managing their human services risk. The fear of assuming risk is most often overshadowed by the greater fear of losing control of this critical system. Similarly, MHAs who are assigning the risk management role to not-for-profit organizations must realize that the conditions which signaled success in grant-funded systems are not the same as the capabilities demanded by risk contracts. Not-for-profit providers may not be able or willing to undergo the reengineering required to combine state-of-the-art business practices with their clear commitment to a social mission. Quality service providers may want to continue to specialize in highly effective clinical care and not to develop a new care management product line.

On the other hand, when MHAs contract with for-profit organizations, there is concern about unnecessary profit decreasing resources for services and supports. With the significant entry of for-profit managed behavioral health care organizations into public sector mental health care, questions have been raised about the place of profits in public business. The National Community Mental Health Care Council, for example, has asked whether there can be "profits with honor" in the public sector. There are those who believe that the not-for-profit providers who have managed the public sector's history should inherit its future. There are also those who see the advantage of equal competition between not-for-profit and for-profit organizations in the interest of quality, cost, and outcomes. In many public markets, consumers and advocates are welcoming the move to managed care, believing that it presents an opportunity and provides some incentives for improving public systems' clinical practices and increasing their consumer focus. There is also a school of thought that advances the position that for-profit managed behavioral health care organizations can often do what government or not-for-profit organizations can't or won't: challenge the *status quo*, provide a third-party view of the public system's performance and re-orient providers' practices toward efficiency and effectiveness.

In states that have created an even playing field between not-for-profit and for-profit organizations in managed mental health care procurements, the MHA has generally paid

close attention to issues of excess profit in relationship to public sector funding. States have either established an administrative/profit cap or have specified the minimum “medical loss ratio”⁷ that is acceptable; more recently, they have linked performance to the level of profit allowed.

Impact of Competitive Outsourcing

As states develop their blueprint for managed behavioral health care, they must project a future view of the role and function of the not-for-profit community mental health industry. Options range from total protection for “essential community providers” where managed care entities are required to do business with a specific list of community providers, to full competition for inclusion in provider panels where “traditionally public” providers participate on an even playing field with other organizations and practitioners. In choosing an approach, states generally attempt to balance the need for providers experienced in public sector services with the potentially positive effects of competition on quality, cost and consumer choice.

While almost every state has grappled with this question, no state has guaranteed future Medicaid revenues to community mental health agencies. Most states have attempted to soften the impact of competitive procurements on public providers by restricting the managed behavioral health care organization’s degree of freedom in choosing providers for its panel or network — at least in the early stages. All states with carve out programs⁸ have specified the qualifications of providers with whom the managed care organization can contract and have also required that the “post managed care” provider availability be as good or better than that which existed “pre managed care.” Some states have required these providers to already have contracts with the State MHA; a few states must actually approve the providers with whom the managed care organization contracts. One state, while not protecting individual providers, requires that half of all beneficiaries referred for specialty treatment be referred to public providers.

Public MHAs’ decisions on roles and opportunities for public sector providers are important for many reasons, not the least of which is that community mental health agencies have had fairly serious reactions to states’ competitive procurements and, in several jurisdictions, have delayed implementation through appeals. Public mental health systems do not have a tradition of competitively purchasing goods and services; the incorporation of this approach often sends shock waves throughout its provider community.

⁷ “Medical loss ratio” is a measure frequently used to evaluate commercial health plans and describes the percent of revenue/premium payments the plan spends on medical care.

⁸ Carve out programs are those in which mental health services are included in the benefit package and then carved out from health services for specialty care management and separate financing.

While some community mental health agencies have attempted to obstruct the movement to at-risk managed care, others have taken more proactive approaches. There are growing numbers of community mental health agencies who are considering, and developing, organizational alliances or affiliations as a means of increasing their leverage and attractiveness to payers and in order to gain the capital and competence required by risk-based managed care. Community mental health agencies are partnering with each other in horizontally integrated structures, creating joint ventures with managed behavioral health care organizations, and joining with diverse sets of health care providers in vertically integrated networks.

Whatever role they assign to not-for-profit community mental health providers, MHAs should not underestimate the public sector's resistance to change. They must also realize that intergovernmental squabbles of the past will continue to haunt the future and can be exacerbated by significant systems change. While the installation of managed care systems can create opportunities for program improvements, its initiation will also create the need to attend to the often overwhelming political forces active within governmental operations.

Future Public Purchasing Decisions

Future public sector managed care activity will occur within the context of its governmental environment, just as previous activity has. Consequently, it is difficult to predict its direction because of counter-balancing pressures. In contrast to a period five years ago when budgetary problems were the backdrop for Medicaid's early managed care efforts, most states' finances are currently in good shape. There may be little impetus, therefore, for taking on the tough work of systems change since governments will not be able to "blame" change on budget deficits. We may, therefore, see fewer public mental health systems that are willing to spend increasingly limited political capital on system re-structuring. On the other hand, MHAs may not be major players in making these decisions, as their presence recedes within large-scale state government reorganizations and there is still pressure for government downsizing and human services re-engineering.

With these countervailing forces, it is still likely that government will continue to adopt private approaches to human service management; mental health systems will be no exception. Managed mental health care contracts may become more regionalized but MHAs will continue to seek innovative public/private partners when a system needs significant restructuring. The use of ASO arrangements may increase in popularity since they allow public providers to retain a greater level of control while still allowing government to capitalize on managed care organizations' technological capabilities. Pressure for consolidation may drive mental health, addictions and child welfare agencies collaboratively to purchase compatible benefit packages from a single point of manage-

ment that integrates, but does not blend, funding streams. Government will continue to rely on private enterprise to perform functions it will not perform itself. Within this environment, MHAs will continue to experience pressure to make smart purchasing decisions about services and systems of care.

Issues Affecting Clinical Practice in an Era of Managed Behavioral Health Care

**James T. Winarski, Martin Cohen, Saul Feldman, Marilyn J. Henderson,
Vivian Jackson, Harriet Lefley, Ronald W. Manderscheid, Peter Panzarino,
Ian Shaffer, Joel Slack, Cynthia Zubritsky**

Introduction and Background

This paper summarizes the most pressing issues affecting clinical practice within emerging systems of managed behavioral health care. It also describes some of the major changes in clinical practice that have been brought about by managed care and analyzes the implications of these changes. It is important to note that many of the challenges described in this paper existed long before the emergence of managed care. However, managed care has provided a new organizational context that has required special responses from clinicians as part of providing effective clinical practice. The specific issues that are addressed include:

- adapting to managed care;
- loss of autonomy and changes in role;
- challenges to providing quality care;
- ethnical standards;
- addressing cultural diversity; and
- developing new competencies.

The behavioral health care field, focusing on the prevention and treatment of mental health and substance abuse problems, has experienced extraordinary change during the last decade. New treatment technologies, the advent of new management systems, the influx of market forces, and shifts in economic and political priorities have had a significant impact on every aspect of service delivery. In spite of all of the rapid changes, there is an emerging consensus among purchasers, providers, and consumers of behavioral health services in both the public and private sector: they share the goal of developing an accessible system that provides quality care at an affordable cost to all people who need it.

Developing and implementing such a system, however, has presented formidable challenges. Medical ethicists have described the fundamental issue as centering around the need to make decisions about how to equitably distribute finite health care resources.

(Boyle and Callahan, 1993) Providing mental health and substance abuse services is especially challenging because of the inherent nature of psychiatric and addictive disorders. Consumers require treatment for problems that are often long in duration, and complicated by complex psychosocial needs related to housing, income, family, and related issues. Acute symptom exacerbations and recurrent crises that are difficult to predict are often part of the course of these disorders.

Managed care has responded with a set of principles and technologies designed with the stated goal of setting limits on spending while still ensuring quality care. The intention is to reduce cost by improving efficiency and carefully monitoring treatment processes and outcomes. Specific cost saving strategies include using less expensive providers, providing care in less expensive settings (i.e., outpatient rather than inpatient), emphasizing short-term treatment methods, creating frameworks for capitated rates, and managing the utilization of services. For many clinicians, experiences of managed care have been difficult and wrought with challenges. The language and technologies of the business world, and the forces of the marketplace, have now entered the clinical process — with profound implications for how clinicians provide care.

The relationship between the clinician and consumer is the focal point of the behavioral health care system. Clinicians routinely deal with issues that are reserved for our most intimate relations. Therefore, it is not surprising that the clinician/consumer relationship has special properties. Managed care has imposed another person, a care manager, onto this dyad. Though insurers have always had a significant influence on the parameters of clinical practice, the input of care managers brings a heightened focus on accountability. Within the resultant triad, the relationship that once focused primarily on issues of individual treatment needs now must also be concerned with controlling costs through improved efficiency and coordination, reducing unnecessary or inappropriate service utilization, and demonstrating quality through measurable outcomes. Though financial considerations were part of managing clinical practices long before the era of managed care, the demands for accountability and standardization and the direct influence of third party payers represent significant change. For clinicians, this has been a difficult transition, one that has become a source of tension in the delivery of managed behavioral health care.

To consider managed care as it relates to clinicians is to address a broad and diverse range of arrangements and relationships. Managed care is not a uniform set of program structures and processes, but a series of technologies with differential applications. Clinicians may work directly for a managed care organization, as in staff model health maintenance organizations (HMOs); contract privately with one or more managed care organizations, as in preferred provider organizations (PPOs); work for a provider that contracts with a managed care organization; or any combination of the above. Two key elements are common to all these relationships and organizational arrangements: (1) the relationship between the clinician and the consumer is a primary determinant

of quality and, (2) the tension introduced by managed care as a third party in the clinician/consumer relationship holds the potential for both positive and negative impacts on the quality of care. (Feldman, 1992) Understanding the experience of clinicians in managed care environments and the effect of managed care on clinical practice is critical to developing effective managed behavioral health care policy and, ultimately, to providing high quality, cost-effective care.

Current Issues

Adapting to Managed Care

Managed care has created a fundamentally new system for organizing and delivering behavioral health services, and is rapidly becoming the standard for health systems management. Clinicians who were accustomed to providing care through a fee-for-service or publicly funded system and who now work under the auspices of a managed behavioral health care organization must make adjustments in practice and attitude, as well as acquire new knowledge and skills. As the number of people served under managed care organizations has increased, the number of clinicians who provide services under agreement with them has also risen. Most clinicians now have experience with providing service in managed care environments and are engaged in a process of adjusting to this new system. Though reactions vary greatly among clinicians, several themes are apparent:

Economic necessity has been a driving force behind change. The shift from providing care to also managing cost represents one of the most significant points of tension for clinicians in managed behavioral health care. Clinicians are generally motivated by the desire to provide high quality care as part of a plan for treatment that combines their best clinical judgement and the preferences of the consumer. The new focus on standardization and cost containment is in conflict with traditional clinical training and provider attitudes. For many clinicians, the transition to managed care is driven by economic necessity and not a belief in its intrinsic value as a method for organizing and providing behavioral health services.

Most clinicians have decided to participate in managed care systems and have adapted their practices in order to remain fiscally viable. Most clinicians also recognize the need to reform the inefficiencies of the traditional fee-for-service system, but would not enthusiastically endorse managed care as a preferred approach. Though economic considerations have always been a part of managing a clinical practice, clinicians were rarely required to play a central role in setting limits on care because of cost. Managed care's mechanisms for controlling costs and placing limits on care creates a conflict of values for many clinicians who only reluctantly participate because of the need to remain employed.

Though contractual parameters for providing treatment also existed in fee for service systems, the pressure to control costs has been greater with managed care benefit packages due to greater levels of oversight and, in some cases, reduced funding and benefits. Clinicians experience tension when they are providing services within the parameters of contracts that do not, in their estimation, provide the resources needed for sound clinical practice.

Clinicians in the public sector face special challenges. For clinicians in publicly financed hospitals and clinics, and those serving publicly insured consumers, managed behavioral health care is a relatively new phenomena. They serve people who have traditionally relied for services upon government-sponsored programs and not-for-profit agencies, and have not experienced the level of oversight and demand for accountability that is common in managed care systems. Managed care organizations now have contracts to provide services to these individuals within a fixed budget that may include some margin of profit. Mechanisms for controlling cost and managing service utilization represents a significant departure from traditional public sector management policies and procedures.

Many publicly funded organizations have not, or have only recently adopted managed care systems. Consequently, public sector clinicians have been required to make significant changes in practice within short periods of time. They expressed concern that managed care cannot adequately serve the large number of low income consumers who have severe and long-term disorders and require a broad range of psychosocial services and supports. Public sector clients, they point out, are also more likely to experience problems that are not reimbursable under current criteria for defining medical necessity.

Clinicians wish to ensure that profits are not realized by compromising the quality of care. In principle, managed behavioral health care controls cost by managing a fixed set of resources that should be distributed equitably over the entire population covered for care. Clinicians have been troubled by the way in which profit motives have affected the distribution of resources in practice. They are particularly concerned about profits being realized at the expense of quality. Cuts in important services, premature discharges, and "revolving door syndromes" have always been a problem, but clinicians now cite an increase in their prevalence as evidence of managed care's tendency to reduce expenditures rather than improve patterns of care.

Strong partnerships between managed care organizations and clinicians are critical to making an effective transition to managed care. The process through which the transition to a managed behavioral health care approach occurs has a significant impact on the clinician's perception of managed care. When managed care organizations include clinicians in decision-making and develop policies that support staff adjustment to administrative change, clinicians are more likely to have a higher regard for managed care. Clinicians who have had managed care imposed on their practice and who do not have a mechanism for participating in the process of change often feel resentful, burdened, uninformed, and unprepared to deal with the transition.

The transition to managed care, like all organizational change, is an evolutionary process. Purchasers, managed care organizations, provider programs, clinicians, and consumers are all becoming increasingly more sophisticated in understanding the theory and practice of managed care models. As sophistication grows, so does the capacity to move beyond simply reacting to change. Key stakeholders should participate in the development of strategies to shape a behavioral health care system that will be responsive to both cost concerns and the complex health care needs of our communities. As direct care givers, the input and leadership of clinicians in shaping future change will be crucial to advancing the evolution of managed care.

Loss of Autonomy/Changes in Role

Professional autonomy is highly valued by clinicians and has traditionally been a significant source of job satisfaction. In the past, clinicians have enjoyed a great deal of latitude in using their clinical judgments to determine treatment activities. The realities of health care financing and the need to manage cost has diminished some of that autonomy and impacted the role of the clinician in several significant ways.

Clinicians have assumed new roles as negotiators and advocates. Although clinicians in managed behavioral health care systems establish plans for treatment, managed care organizations and purchasers hold the ultimate decision-making authority, based in benefits packages, practice guidelines, and/or utilization review. Care managers are now routinely involved in decisions regarding the type and amount of care that will be approved and reimbursed. Though protocols and standards have been established to facilitate a care approval process that is efficient and responsive to consumer need, the role of the clinician has shifted from being the prime decision-maker to the prime advocate. As decision-making authority has diminished, clinicians have been required to take on new roles as negotiators, balancing the need to control cost and provide quality care, while also balancing the interests of the managed care organization and the consumer. In addition to providing treatment within the parameters of a benefit package, clinicians are often required to demonstrate the needs of the consumer to managed care organization staff, as well as translate the rules of the organization to the consumer. Clinicians also may advocate for consumers through an appeals process, established by managed care organizations to deal with differences of opinion that cannot be reconciled through standard procedures for approving services.

Each of the professional disciplines has experienced some change in roles and responsibilities. Managed care organizations generally pay for clinicians who can provide services at the lowest cost under current standards for practice. Treatment activities are more often organized in relation to function rather than professional discipline. The traditional discipline-based lines of authority and responsibility have been redefined in managed care environments. Psychiatry, psychology, psychiatric nursing, and social work have

all experienced some change in the types of clinical activities performed. For example, medication management has become a predominant activity for psychiatrists, while diagnostic assessments and psychotherapy are now often performed by less expensive mental health clinicians or primary care physicians. Treatment plans typically include a series of activities that require clinicians to assume a range of roles and functions that are coordinated by a care manager. Clinicians from nursing and social work have also taken on a greater role in providing triage and case management functions. Traditional discipline-based compensation is also being modified, with some companies paying for "therapy" at the same rate regardless of the discipline of the provider. There is generally greater emphasis on flexibility and teamwork among the professional disciplines.

Strategies for managing service utilization have impacted the length and locus of care. A significant mechanism for controlling cost in managed care involves managing service utilization. Managed care organizations seek to reduce unnecessary visits and provide care in the least expensive settings. They emphasize outpatient, time limited, episode-based segments of treatment with goal-oriented objectives. Behavioral and cognitive therapies have replaced long term, insight-oriented psychotherapies. Clinicians in solo private practice have responded to managed care's cost control requirements by discounting fees, consolidating provider groups, and emphasizing short term treatment approaches in outpatient settings.

New roles and changes in professional identity require that managed care organizations and clinicians develop new partnerships. Clinicians without a background in the business or managerial aspects of behavioral health services may not be adequately equipped to be successful in managed care environments. Some clinicians have complained that new management systems have been imposed without sufficient clinician input and without allocating the time and resources required for effective "retooling." The purchasers, providers, and consumers of services will all benefit from clinicians working in partnership with managed care organizations on cost and quality management strategies; and the organizations themselves could advance this partnership by involving clinicians in all phases of planning and implementation.

Challenges to Providing Quality Care

The initial force behind managed behavioral health care was the need to control escalating costs. However, purchasers of care are now beginning to demand documentation that services are effective. Providing quality care is no longer just a guiding principle but an economic imperative.

Although there is universal agreement on the need to provide quality care, regardless of the system used to manage and finance that care, defining, measuring, and managing quality in the behavioral health care field has been especially challenging. What is quality care? What processes are used to measure quality? What kinds of and how much service

does a consumer really need? How do managed care organizations, clinicians, and consumers know if a service has been successful? Many believe there is rarely a clear cut relationship between diagnosis and treatment needs; between process and outcome. Clinicians have traditionally had a wide range of discretion in determining the choice and course of treatment activities, without clear criteria for determining success. Managed care's emphasis on accountability has challenged the behavioral health care field to define quality in terms of quantifiable outcomes. The cost management issues discussed below have significantly impacted clinician practice.

Clinicians need to be active in developing outcome data that accurately define quality care. The process of treatment planning requires that clinicians and care managers routinely predict the likelihood of a particular intervention being successful. Consequently, it is critical to have a reliable base of evidence about the relative effectiveness of various treatment modalities. In spite of efforts by clinicians and researchers to document "best practices," there is not always consensus about what is considered a successful intervention. Though there has been substantial progress in developing empirically based outcome indicators, clinicians and care managers routinely determine courses of treatment based on "best guesses." Systems of care mapping and critical pathways have been designed to assist clinicians with selecting appropriate interventions. These methods are helpful, but only as good as the outcome data that support them.

Treatment planning for behavioral health care is a complex process in large part because the course of illnesses and addictions, and the stages of recovery, can vary greatly among individuals. In addition, it is important to distinguish between short and long term goals for treatment and to understand the complex relationships between treatment interventions and outcomes. Determining who should be involved in specifying the outcomes that define treatment provision and reimbursement can be especially complicated in the behavioral health care field because of community concern about these problems, and the broad range of stakeholders who have a legitimate interest: consumers and family members, treatment programs, payers, managed care organizations, regulatory agencies and monitors, criminal justice and social service systems, employers, and the general public. (Edmunds et al., 1997) Given these complexities, it is not surprising that there is no standard set of outcomes and outcome measures, and that preferred measures vary widely across stakeholders. Unfortunately, clinicians are responsible for assuming the burden that comes with increased demands for quality without accepted definitions or adequate methods and tools for measuring it. Much needs to be done to develop appropriate vehicles to define and measure outcomes, to provide adequate guidelines for clinicians, and to ensure that care is judged on the basis of its quality rather than solely on its cost. (Manderscheid and Henderson, 1996)

Clinical guidelines need to be accurate, reliable, and flexible. Capitation is an important method for managing costs and controlling financial risk. Accurate capitation rate estimates require an analysis of expected performance, desired outcomes, utilization

data, and characteristics of the covered population, all of which needs to be linked to clinical guidelines that provide clear standards for treatment. Guidelines should also be flexible, evidence-based, and able to accommodate the sometimes unpredictable course of behavioral health disorders.

Outcome measures and clinical guidelines need to reflect the range of differences in the types and severity of problems treated, the various stages of illness and recovery, cultural/environmental factors, and individual consumer preferences. Translating outcome data into useful clinical guidelines presents special challenges for both the managed care organizations responsible for developing them and the clinicians who have had difficulty adjusting to this standardized approach to care. Mental health and substance abuse clinicians have traditionally viewed recovery as a process that varies among individuals, is influenced significantly by non-medical environmental factors, and is extremely difficult to predict. Consequently, they typically perceive behavioral health care as being an art as well as a science. Nevertheless, the demand for accountability remains.

Using outcomes as incentives will require some adjustment for economic risk. Clinicians have significant reservations about linking financial rewards to clinical outcomes. They contend that doing so puts them at great economic risk because of the lack of guidelines that accurately reflect the relationships among diagnoses, treatment activities, and outcomes. Linking financial rewards to clinical outcomes first requires development of standard criteria to predict accurately the various levels of financial risk that different consumers bring to a clinician's caseload; rewards and incentives can then be adjusted accordingly. Because it is difficult to predict both the course of behavioral health disorders and the outcomes for different treatment modalities, positive and/or negative consumer outcomes may not be the most accurate gauge of clinician competence or effort. Clinicians are concerned about being judged by measures that are not fully valid or reliable. It is also not clear how both long- and short-term outcomes should be applied as measures of success, especially when clinical guidelines emphasize short term treatment approaches.

Clinicians, consumers, families, payers, regulatory agencies, and other key stakeholders often have dramatically different interpretations of what constitutes an acceptable outcome. In addition, the great variability among individuals in responding to treatment, the chronic nature of many behavioral health disorders, and the need to provide long-term care are also of great concern to clinicians. Indeed, the complex biological, psychological, and social factors that contribute to recovery, including consumer readiness and motivation to engage in treatment, are often beyond the control of clinician influence. The potential for creating disincentives for treating consumers with difficult problems through capitation and case rates also introduces ethical dilemmas. Individuals with the greatest need for care are often the least likely to demonstrate immediate discernable improvement. Requiring clinicians to assume personal economic risk in caring for

these individuals would be unfair to both the consumer and the clinician until adjustments for risk can be agreed upon.

Credentialing programs need to be coordinated and simplified. Managed care organizations and the professional disciplines rely on the process of credentialing as an important mechanism to ensure the provision of quality services. The credentialing process usually includes setting a standard for clinician competence, establishing a mechanism for on-going review, and restricting the practice of clinicians who violate practice standards. Credentials also provide a basis for determining rates for clinician reimbursement. Though most clinicians support the need for credentialing in managed behavioral health care, the current system of multiple and complex programs for credentialing is confusing and costly to administer. State regulatory boards credential through licensure. Managed care organizations credential through an application process in which education, experience, supervision, malpractice experience and coverage, licensure, and documented expertise are evaluated and reviewed managed care organizations. Managed care organizations also "privilege" clinicians to perform certain designated tasks such as family therapy or crisis intervention. Professional disciplines credential through special certification boards that evaluate levels of knowledge and performance. Integrating credentialing programs as part of a coordinated system would simplify procedures, reduce cost, and enhance the utility of this important quality assurance mechanism.

Consumers and paraprofessionals often provide behavioral health care services, but, because they are not credentialed, there have been problems with creating mechanisms for reimbursement and quality management under managed care. Some benefit plans and managed care organizations expect that each individual having a therapeutic role in a clinical setting be licensed by the state; they do not always recognize the quality assurance functions and liability for malpractice that already existed within the organization. There is a consensus on the importance of including consumers and paraprofessionals in providing care and on the need for fair reimbursement, but there is little agreement as to how this should be accomplished. Future discussions clearly require major input from consumers and paraprofessionals.

Advances in technology and automation have been hindered by the lack of a standardized data system. The capacity to compile, track, and analyze information is critical to quality improvement in managed behavioral health care. Managed care organizations have been at the forefront of developing new technologies and management information systems. These systems have the capacity to track indicators on quality, access and cost, and contribute to effective decision making in all phases of care. Clinicians can use these systems to manage more efficiently multiple levels of care for populations with diverse needs. However, the current lack of standardized data and integrated information systems significantly limits the utility of this technology. Similarly, the absence of dialogue between clinicians and information technology personnel in the design, implementation, evaluation, and improvement of these systems further constricts

their value. There is a need for the behavioral health care industry as a whole to come to an agreement on standard data collection processes.

Measurement tools built with input from a wide range of stakeholders now exist, and need to be used more extensively. Supported by the Center for Mental Health Services, the Mental Health Statistics Improvement Program (MHSIP) has developed a consumer-oriented report card that assesses mental health and substance abuse services across the critical domains of access, appropriateness, outcomes, consumer satisfaction, and prevention (MHSIP, 1996) and a minimum data set for enrollment and encounter data. In addition, the Center for Mental Health Services is conducting an on-going Human Resource Workgroup that has drafted a minimum data set for human resources data. Such data would allow corporate purchasers, state agencies, and consumers to compare the performance of different health plans.

Ethical Standards

Clinicians have been required to deal with ethical problems well before the advent of managed care and many of the current ethical issues are part of profound cultural changes that extend beyond the health care field. Responding to ethical dilemmas has long been a part of clinical training programs, professional codes of conduct, clinical supervision protocols, and program policy development. However, managed care has introduced some new ethical challenges that require the development of new ethical standards. Clinicians have been most affected by issues related to privacy, confidentiality, and the need to balance quality and cost effectiveness.

Clinicians need to ensure trust and confidence in the clinician/consumer relationship. Trust and confidence in the clinician-consumer relationship is an integral component of delivering quality health care. Privacy is especially important to consumers of behavioral health care services because of the stigma attached to mental illness and substance abuse. However, managed care organizations argue that they need to know about an individual's diagnosis, life situation, functioning, and treatment in order to make accurate determinations about the necessity for and level of care that should be provided. Clinicians are often required to share consumer information not only with the payer for services but also a case manager. As group treatment becomes a more prevalent treatment modality, consumers share private information with increasing numbers of individuals other than their clinicians. Specific policies and procedures need to be developed for dealing with issues of disclosure and privacy for all these circumstances. The advent of consolidated data systems also increases the potential for violating consumer privacy and highlights the need for safeguards.

The demand for quality care and cost control can create conflicting interests. The conflicts that occur as a consequence of employees representing the interests of both

an organization and a consumer are certainly not unique to health care or managed care. Clinicians have always had to address the needs of the consumer within the parameters of institutional structures. However, they balanced consumer and institutional concerns from within an autonomous clinician/consumer relationship. By directly introducing a third party into this relationship and instituting a process of quality and cost control, the need for clinicians to balance a variety of conflicting interests has become a routine part of clinical practice. Whether the tensions inherent in balancing cost and quality have a positive or negative impact on consumer care is dependent upon both the managed care organization's standards and practices and the conduct of the clinician. The following ethical questions are common to clinicians working in managed behavioral health care settings:

- When differences of opinion with care managers about the need for clinical service cannot be resolved, and the clinician is convinced that deleterious consequences will result from withholding services, what course of action should he or she take?
- When networks create financial incentives for reducing service utilization, how can clinicians make clinical decisions that are truly in the best interest of the consumer?
- When clinicians can be dropped from managed care networks because of differences in interpretation of criteria for providing care, how can they make clinical decisions that are truly in the best interest of the consumer?

Ethical issues related to privacy, confidentiality, and managing cost and quality in managed care environments are of critical importance to clinicians, managed care organizations, and consumers; existing codes of professional ethics and organizational procedures for approving care are two primary areas that need to evolve.

Addressing Cultural Diversity

The great cultural, ethnic, and racial diversity of the United States and cultural differences among consumers and clinicians has important implications for the delivery of managed behavioral health care. The field is developing a greater appreciation for how an individual's cultural background influences perception, beliefs, and behaviors related to the experience of health, illness, treatment, and recovery and how these factors affect the quality and outcomes of care. Clinicians can demonstrate cultural competence by accounting for cultural factors in history-taking and assessments, by making multilingual staff or interpreters available, and by adapting patterns of communication and treatment interventions that are sensitive to the beliefs and practices of an individual's culture.

There is a general consensus that clinicians need to be culturally competent, adjusting practice styles to accommodate the needs of different cultural groups. To advance cultural competence, managed behavioral health care organizations should recruit and retain culturally competent staff and establish policies, procedures, and practices that accommodate diversity and encourage culturally sensitive interventions. Purchasers should require managed care organizations and networks to have culturally diverse clinicians and management staff. Federal and state governments should take a leadership role in ensuring that culture is not a barrier to receiving quality health care in both the public and private sector.

Developing New Competencies

The changes brought about by managed behavioral health care have influenced the core set of competencies required to maintain a successful practice. Clinicians now need to develop greater expertise in the areas of brief treatment, group work, and care management; in addition, they need management, computer, and outcome/evaluation skills. Providers have needed to acquire new staff and develop the knowledge and skill levels of their current staff to function effectively in managed care systems. Managed care organizations, service provider agencies, and clinicians themselves indicate that training programs have not adequately prepared clinicians to work in managed care environments. A prime problem has been the lack of resources designated for training in academic settings and after graduation. For example, since managed care organizations do not reimburse interns for providing treatment in clinical training programs, options for training sites have diminished. Experienced clinicians who completed their formal education prior to the advent of managed care, need continuing education about managed care technologies. There is general agreement that both public and private payers need to share responsibility, and that states, counties, managed care organizations, and provider organizations all need to support the training of the next generation of clinicians as well as the continuing education of the current generation.

Conclusion

As the next generation of managed behavioral health care moves from a focus on cost toward an investment in quality, clinicians will be required to play a larger role in shaping the process and outcomes of service delivery. Organizational change is never accomplished without growing pains, but the rapid and sometimes radical changes brought about by managed care have caused reverberations across our entire culture. Clinicians represent the point at which theories and systems of management translate into the actual care of consumers. For managed behavioral health care to achieve its goal of providing

quality care at an affordable cost, the adjustments required in clinical practice need to be recognized as one of the primary determinants of quality. As the field continues to evolve, it is critical that individuals in clinical practice evolve as well. Advances in management technologies, evaluation, and services research need to be applied under real world conditions where problems are complex, the pace is fast, and the forces of the marketplace are powerful. Success in clinical settings requires the continued development of partnerships among all key stakeholders, including clinicians, consumers, providers, payers, government agencies, and managed care organizations.

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Clinical Practice Guidelines

**Denise Noonan, Robert Coursey, Janice Berry Edwards, Allen Frances,
Tom Fritz, Marilyn J. Henderson, Anne Krauss, Tom Leibfried,
Ronald W. Manderscheid, Sarah Minden, Kirk Strosahl**

Introduction and Background

Containing health care costs while maintaining quality is a challenge that has inspired a number of innovations in health care, including clinical practice guidelines. This paper summarizes the critical issues relating to the development and use of guidelines and suggests directions for advancement of the field. The issues discussed include:

- the process of developing clinical practice guidelines and standards for guidelines;
- the implementation of clinical practice guidelines;
- the role of guidelines in quality improvement; and
- the future of clinical practice guidelines.

The treatment of people with serious mental illness has changed dramatically over the past 30 years. Improved psychotropic medications, deinstitutionalization, and restructuring of the financing of health care are among the factors that have contributed to such a transformation. Increasingly, this population receives services in managed behavioral health care settings, whether in the public or private sector. Governments at the local, state and Federal levels now routinely contract with private for-profit managed care organizations to provide services for their most vulnerable citizens.

The shift from a fee-for-service system to population-based flat fees or capitation arrangements has created incentives to control costs, primarily by negotiating discount rates for providers and by restricting services to those deemed "medically necessary." Medical necessity might be narrowly defined as the clinical services needed to diagnose and treat particular conditions, or, it might be more broadly defined to include whatever services (psychosocial or vocational rehabilitation, housing, case management) are necessary to ensure an optimum level of functioning and quality of life (Bazelon Center, 1997). There is significant concern that inadequate or inappropriate care may result from attempts to save money by restricting or denying access to needed treatments or services. It is vitally important that consumers, providers, and purchasers of these services have tools to help them evaluate their quality. Clinical practice guidelines are one such tool.

Clinical practice guidelines are defined as "systematically developed statements to assist

practitioner and patient decisions about appropriate health care for specific clinical circumstances.” (IOM, 1990) While their primary purpose is to guide clinical decision-making, they can be used to:

- improve quality, appropriateness and effectiveness of care by specifying processes of care known to be associated with good outcomes;
- decrease costs by reducing ineffective or unnecessary services and enhancing coordination of care;
- help consumers make informed choices;
- assist consumers and their families in advocacy efforts;
- assist payers in establishing rates of reimbursement;
- encourage standardization of clinical data for purposes of outcome research; and
- improve clinical training.

Practice guidelines were first envisioned as a strategy for reducing variation in practices such that consumer outcomes would be more predictable and favorable. Unnecessary and inappropriate treatment of medical conditions would be reduced, resulting in lower costs. Two types of guidelines emerged, the first to guide decision-making about level of care (e.g., inpatient, intermediate, ambulatory) and the second to guide the types and processes of care. This paper will focus primarily on the latter type of guidelines. Over the years, hundreds of practice guidelines have been written and their uses, merits, and risks have been debated. Many concerns were raised: guidelines might be used to restrict or deny access to services in order to save money; might not include treatments of known benefit due to the bias of their authors; could discourage independent or innovative thinking by clinicians; might increase malpractice litigation; and might be used punitively to evaluate and sanction clinicians.

Over time there has been increasing acceptance of guidelines, especially by providers who see them as a welcome support when treating complicated conditions (Shye, 1995). Today it is clear that guidelines are here to stay. Discussion now centers on questions such as who should develop guidelines, what makes a good guideline, what are appropriate uses for guidelines, and how guidelines should be adapted to the needs of the setting and the individual consumer.

The Process of Developing Clinical Practice Guidelines and Guideline Standards

Guideline development in behavioral health care is especially challenging because of the variety of perspectives that different stakeholders bring to the task. Provider guilds have varying theoretical models of treatment and compete for the opportunity to deliver

services. Managed care organizations view behavioral health care as an area in which restriction of services can potentially increase profits. Knowledgeable, well-organized consumer and family advocacy groups expect an opportunity for input and choice. Not surprisingly, the current status of practice guidelines in behavioral health care is a reflection of the field, with all of its complexity, ambiguity, and competing agendas.

Guidelines for guidelines. The behavioral health care field now has a decade's worth of clinical guidelines to examine and compare along a number of different dimensions. The Institute of Medicine (IOM), which has assisted the Agency for Health Care Policy and Research (AHCPR) in developing strategies for creating and implementing guidelines, specified eight criteria by which guidelines should be evaluated. (IOM, 1990)

- **Validity** – Faithful adherence to a valid guideline will lead to the expected health and cost outcomes.
- **Reliability/reproducibility** – Groups of experts would independently arrive at the same recommendations given the same scientific information; different practitioners would consistently apply and interpret the guidelines in similar clinical situations.
- **Clinical applicability** – Guidelines should specify the populations to which they apply and be as broadly applicable as possible based on current scientific and clinical information.
- **Clinical flexibility** – Guidelines should specify any known exceptions to their recommendations.
- **Clarity** – Guidelines should be written in clear, precise language and presented in user- friendly formats.
- **Multidisciplinary development process** – Groups who will be affected by the guideline should have a role in their development.
- **Scheduled review** – Guidelines should specify when a review is recommended.
- **Documentation of the process** – The entire process of guideline development (methods, participants, scientific evidence, etc.) should be documented.

Guideline limitations. Experts in the field of practice guidelines find that a number of the available guidelines fall short of these standards. Many guidelines are proprietary; especially those developed by managed care organizations. Closed to public scrutiny, there is a danger that such guidelines may inappropriately serve certain needs of the organization at the expense of the consumer. Moreover, guidelines are often developed without consumer input. Consumers emphasize that without their input there may be insufficient attention paid to such issues as choice, collaboration in treatment planning, and inclusion of services such as psychosocial rehabilitation, case management, and housing. Consumers want to be included from the beginning of the development

process where they believe they can make suggestions that will enhance the likelihood of a collaborative consumer-provider relationship.

Many guidelines are too long and too complicated; implementation of overly complicated guidelines is unlikely. Guidelines are not specifically targeted to the type of practitioner who will use them. The practitioner may have a different background or level of expertise than assumed by the guideline. Educational materials that would promote better understanding of the guideline by consumers and practitioners are generally inadequate.

Improving guidelines. Growing awareness of the limitations of available guidelines has led to efforts to improve their quality. A number of organizations have been involved in this endeavor including: the Agency for Health Care Policy and Research which established standards for guidelines (Woolf, 1991) and the Institute of Medicine developed a "provisional instrument" for evaluating clinical practice guidelines (IOM, 1992). The American Psychological Association produced a "Template for Psychological Intervention Guidelines" which is being used to evaluate the scientific validity and clinical effectiveness of existing guidelines, including those of managed care organizations (Abrahamson, 1997). Finally, the Practice Guideline Coalition was founded to bring together all of the parties with an interest in guidelines to develop, distribute and implement "non-proprietary, user-friendly, scientifically-based clinical practice guidelines" (Practice Guideline Coalition, 1998).

Consensus-based guidelines. Another noteworthy trend in the development of clinical practice guidelines has been a diminishing reliance on the results of randomized controlled treatment trials. While this is the recognized standard for clinical research, it is difficult to design feasible studies that reflect the complexities of the "real world" in which people with mental illness have coexisting substance abuse and medical conditions and receive multiple therapies. The limitations resulting from adherence to true experimental designs have led some guideline developers to rely more heavily on the consensus of experienced clinicians regarding key clinical decision points. The Expert Consensus Series of guidelines is representative of this approach (Frances, Docherty & Kahn, 1996). The Practice Guideline Coalition also uses a consensus approach, but goes beyond clinicians to include consumers, family members, representatives of managed care organizations, and other stakeholders in the process of guideline development. While a consensus approach offers some practical advantages, it is important that experts' opinions be grounded in knowledge based on the most current and reliable data derived from rigorous research. It is also incumbent upon researchers to attempt to design studies that more closely approximate "real world" settings.

Data-based guidelines. Yet another approach to guideline development is to base recommendations on information culled from large databases. Information obtained at intake, during treatment, and at follow-up is analyzed for use in shaping treatment protocols (Faulkner & Gray, 1992; Pigott, 1995). As information systems become more sophisticated, it is possible to continually feed outcome data back into the loop and revise

guidelines as necessary. This process has the advantage of producing guidelines that are tailored to the needs of a particular clinical setting and that can be frequently updated.

Implementation of Clinical Practice Guidelines

Too often, guidelines sit unused on shelves in clinicians' offices. The documents may be too long, too complicated, presented in a confusing format, geared to a different audience, or better suited to another clinical population or setting (Lomas, 1989, 1991). Even a "good" guideline can languish in obscurity if proper attention is not paid to the implementation process.

Strategies for Enhancing Use of Guidelines

"Translating" guidelines. Guidelines are commonly modified for local use. This process is sometimes referred to as "translating" a guideline, and can be beneficial in a number of ways. It can create a more user friendly format and a better fit can be tailored to the unique characteristics of the local organization and its community. Consumer preferences as well as the opinions of providers can be incorporated. Credibility of the guideline can be enhanced if the translation is done by respected colleagues. During this process, suspected barriers to implementation can be identified and steps can be taken to reduce or eliminate them.

The challenge of guideline translation is to preserve the overall message while increasing the likelihood that the guidelines will be used. There are some strategies for guideline modification, however, that run the risk of disconnecting the guideline from its scientific base, thereby introducing bias or inaccuracy. "Academic detailing," for example, is a technique that selects a limited number of clinical behaviors from a guideline and implements only those. (Soumerai and Avorn, 1990) While this strategy can be a useful approach to addressing local problems, care must be taken to maintain the integrity of the guideline. Clinical quality improvement efforts that selectively implement segments of a guideline may also undermine its validity. (Brown et al., 1995) However, without efforts to modify guidelines, they are far less likely to have widespread use. (Brown, Shye & McFarland, 1995)

Incentives and penalties. Other strategies, some controversial, have been proposed to encourage implementation of guidelines. These include legislation to protect providers who follow guidelines from malpractice litigation (Barlow & Barlow, 1995), financial incentives for providers who practice according to established protocols, and sanctions against those who fail to adhere to guidelines. Many experts in the field believe that such proposals are ill advised. Ultimately, treatment decisions must be made in the context of a collaborative relationship between clinician and consumer. The decision-making should be informed by the guideline, not ruled by it.

Format. Experience with guidelines in managed behavioral health care settings has shown that there are a number of tools that can be derived from guidelines that enhance their usefulness. (Gottlieb, 1993) Guidelines presented in algorithmic formats tend to be brief and easily followed. Guidelines on discs can be used on desktop computers and durable laminated cards containing only the key clinical decision-making points can be carried by clinicians; such formats are also suited to preferred drug lists based on first, second and third line treatments for conditions covered by guidelines. Clinical reminder systems based on guidelines include automated laboratory and medical record systems that generate notices to clinicians if there is an unusual finding or follow-up is recommended at certain intervals. CD-ROMs published by guideline developers could provide detailed information about the scientific basis for the guideline and synopses of key reports in the literature.

Education. Experts in the field advocate strongly for a variety of educational programs to accompany clinical practice guidelines. These programs should be targeted at consumers, families of consumers, practicing providers, and providers in training. For consumers, materials can be presented in a discussion or document format to promote understanding of a condition and options for treatment. Consumers want tools to help them engage actively in treatment planning. They want to know about the risks and benefits of standard and alternative treatments.

Educational programs can familiarize established clinicians with the scientific basis for a guideline and review skills required for providing the recommended treatments. Trainees in all behavioral health care disciplines should understand the process of guideline development, be able to distinguish good from flawed guidelines, and be familiar with the quality guidelines for the conditions they are likely to encounter in their professional work.

Challenges to Implementation in the Public Sector

Implementation of practice guidelines in public sector behavioral health settings presents special challenges. A number of Federal and state funded programs are working towards implementation, some with the assistance of guideline developers, and trying to address a variety of complicating factors. For example, coexisting major mental illness and substance abuse is extremely common in the population served by the public sector; most guidelines, however, address only a single diagnosis. Furthermore, the public sector population includes many people who do not respond, or only partially respond, to psychopharmacological treatment. Most guidelines do not give clear indications about how to proceed in difficult to treat cases. People with serious mental illness often use case management and a variety of social services such as housing, vocational rehabilitation, and social skills building programs; most guidelines do not adequately address these psychosocial interventions.

Many people who are treated in public mental health systems receive their care across a mixture of public and private facilities. Public and private settings may not use the same guidelines, creating potential inconsistencies in care. For example, guidelines that recommend expensive first line treatments for serious illnesses may make it difficult for publicly funded programs to comply due to budgetary constraints. Many would argue, however, that in the long run expensive treatments are cost-effective if they prevent treatment failures and optimize functionality and quality of life.

Clinicians and administrators in the public sector appreciate the value of guidelines and are beginning to develop tools that are better suited to their needs. As public mental health authorities and Medicaid agencies contract for services with managed behavioral health care organizations, they can include adherence to specific guidelines in their contracts. Government officials need guidelines that lay out the current understanding of the most effective interventions for treating people with serious disorders. These recommendations should be derived from the best scientific and clinical information available, without regard to cost. Only then can there be a meaningful consideration of costs — not only the direct costs of providing high quality care but also the indirect costs (e.g., poor quality of life, repeated hospitalization) of providing inferior care.

The Role of Guidelines in Quality Improvement

Clinical practice guidelines have proven to be useful components of quality management programs (Gottlieb, 1990, Pigott, 1995). They provide a framework for discussions about clinical decision-making, standards of care, and cost of care. They may also soon become required components of quality management. In April 1997, the National Committee on Quality Assurance (NCQA) published new Standards for Accreditation of Managed Behavioral Healthcare Organizations. They require that organizations select clinical practice guidelines and make them available to their providers. In addition, each year the organizations must measure provider adherence to a minimum of two of the guidelines.

Adherence to guidelines is of no benefit unless the outcome for the consumer is of acceptable quality. Efforts are underway to link practice guidelines to outcomes analysis so that the effectiveness of particular processes of care can be examined. AHCPR (1995) has been working on a methodology for using practice guidelines to evaluate quality of care. Guidelines form the basis for both medical review criteria, which are used to assess specific decisions, services and outcomes, and for performance measures, which monitor the extent to which a provider's service conforms to a guideline. The measurements derived from these evaluation tools can be compared to standards of quality to determine whether the care delivered is at an acceptable level. The quality management cycle is complete when data from this process is used to update a guideline.

The proprietary nature of most managed care organization guidelines raises strong concerns that quality of care may not be properly balanced against cost considerations. While it is true that practice guidelines were envisioned as a tool for cost containment, the goal was to create savings by reducing unnecessary or inappropriate care. A good practice guideline should allow clinicians, consumers, and others to see clearly the interventions and services that are associated with the best outcomes. Interventions that are equally effective, but of lower cost, should be highlighted. Decisions about the costs of delivering care to individuals or populations may belong more properly to discussions of standards of quality or to contract negotiations than to clinical practice guidelines.

Understanding the complex interrelationships among structure, process, and outcomes in behavioral health care is clearly important. Consumers and clinicians need information about outcomes for large groups of consumers to guide them in making the best decisions for each individual. Clinicians and managed care organizations need information about individual providers and how their performance compares with other providers to assess and improve care. And payers and purchasers of health care need information to help them decide what they should pay for and to determine if quality care was delivered. Outcome studies will enable the identification of systems or sites that successfully implement guidelines.

Experts in the area of clinical practice guidelines point out, however, that linking guidelines to outcomes should proceed with caution. In the first place, experience with the development and implementation of guidelines is relatively limited and, in the second place, outcome research is a complicated and expensive endeavor in the behavioral health sciences. Outcomes can be defined in many different ways: short or long term, broadly related to mental health and substance abuse conditions, or specific to a diagnosis or individual. Furthermore, it is challenging to define "good" outcomes for behavioral health problems because of lack of consensus among interested parties. This is an area that will benefit substantially from a collaborative effort by researchers, consumers and families, clinicians and health care administrators.

The Future of Clinical Practice Guidelines

The behavioral health care field has not yet achieved the level of acceptance afforded other areas of health care. There is skepticism about the kinds of treatment that are delivered in clinicians' offices and how those treatments impact the well being of consumers. The field has been slow to convincingly demonstrate that it can provide effective treatment at an affordable cost. This has contributed to a reluctance to pay for these services on the part of insurers, employers, and managed care organizations. Practice guidelines are beneficial to the field in that they give consumers, purchasers, administrators, and

practitioners a window into the consulting room. They can see "best practices" and compare promised or delivered services to these standards.

Clinical practice guidelines will not and should not eliminate controversy in the field. There will continue to be disputes about who should deliver care, what treatments work best, and how to pay for services. Such disputes derive from the diversity of interests in the field and can, at best, stimulate creative problem solving. Development of guidelines offers the mental health care field an opportunity to bring diverse groups together to try to reach consensus on major points of disagreement. Of course, some justifiable and sincere differences of opinion will remain.

There is strong consensus among experts in the area of clinical practice guidelines that they are potentially valuable tools when developed, modified, and implemented in a collaborative, scientifically valid and pragmatic manner. Experts make a number of suggestions towards that end:

Stakeholder involvement. Guidelines should be developed through a systematic process involving all interested parties: consumers and families, advocacy groups, providers, researchers, educators, purchasers, government officials, and health care delivery system administrators. Representation of diverse interest ensures that issues such as theoretical perspective, consumer choice, cost and health care policy will be considered. In this way, the needs of all those affected can be addressed.

Standardization. Guidelines should meet high standards for quality. The mental health care field should adopt some universal standards that would assist those who are developing guidelines as well as those who need to evaluate their quality. Standards need not dictate a single method for developing a guideline, but instead would define the basic parameters for a guideline such as validity, reliability, and clarity.

Evidence- and consensus-based. There is a public need for guidelines that have been developed with the sole purpose of identifying the interventions that research and clinical experience suggest are associated with optimal quality of life for people suffering from serious disorders. These can help decision-makers balance quality and cost considerations.

Open to scrutiny. Guidelines should be nonproprietary. Managed care organizations should be free to adapt and implement guidelines according to their needs, but these documents should be available for review by consumers, purchasers, and accrediting bodies. Interested parties have a right to know that the treatments recommended are associated with the best possible outcomes according to the latest scientific information.

Easily used, culturally competent, and flexible. Guidelines should be brief, concise documents that are easy to follow. Educational materials for consumers, family members and providers should support them. Guidelines should be sensitive to ethnic, religious or cultural factors that may bear upon consumers' acceptance or rejection of a recommendation for intervention. Guidelines should be updated on a regular basis to reflect new treatments, problems with existing strategies, and results of outcome studies.

Useful to primary care. Guidelines should be applicable to both primary and specialty care settings. As many as 50 percent of all mental health and substance abuse treatment episodes occur in a primary care setting. In order to improve recognition and treatment of behavioral health problems, primary care providers must have access to clear, practical guidelines.

Training. Clinicians in training should be introduced to guidelines that are relevant to their areas of expertise. They should understand the characteristics of a good guideline and the role of guidelines in clinical quality improvement.

Expand development. Guidelines are currently available for only a limited number of conditions. Priority should be given to the development of guidelines for high-risk conditions such as dual diagnosis. Guidelines for disorders of childhood and adolescence are largely unavailable and need attention. Guidelines should consider the need for coordination of treatment for populations across a variety of settings.

Conclusion

There is much to learn about clinical practice guidelines. Empirical studies have yet to determine whether guidelines contribute to improved outcomes for consumers, limit unnecessary or inappropriate care or reduce costs. At the very least, the concept of guidelines has captured the interest of groups with diverse and sometimes competing agendas and has fostered communication about issues of quality, cost, and accountability. Further experience with implementation of guidelines and assessment of their usefulness will clarify their future potential.

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Measuring Outcomes of Mental Health Care Services

**Sarah Minden, Jean Campbell, Jeanne Dumont, Bill Fisher,
Laurie Flynn, Marilyn J. Henderson, J. Rock Johnson,
Teresa Kramer, Ronald W. Manderscheid, Deborah Nelson,
Peter Panzarino, Paul Weaver, Gayle Zieman**

Introduction

Consumers of mental health services want to determine the quality of the care they receive. Purchasers of services want to know that what they pay for is of value. Both constituencies increasingly demand that quality be demonstrated in an objective and clear manner. It is no longer enough for providers, insurers, and managed care organizations simply to claim that care is "good": they must prove it. These new expectations have led to important advances in our ability to measure the quality of care.

From the consumer's perspective, one of the most important ways of judging the quality of care is by its outcome. A consumer might ask: "What were the effects of the services I received? What impact did they have on my life? Were things better or worse as a result of my receiving the services? Did they help me achieve my goals?" The answers to these questions can help the consumer decide whether to continue using the services, how to change them, and what to look for in accessing mental health services.

For providers — whether clinicians working with individual consumers, state or county mental health authorities providing services for a community, or managed behavioral health care organizations delivering care to an eligible population — information about the outcome of care is essential for improving its quality. Providers might ask: "What were the results of the services provided? Were things better or worse as a result of the services? If not, what changes should we make?" Whether these questions refer to the treatment of one individual or to a wide range of services for a whole group of people, the answers can effectively guide decisions for enhancing the quality of care in the future.

Purchasers of services, whether employers or government agencies, use data on outcomes to choose wisely among health care plans. Purchasers might ask: "How do the outcomes achieved by different organizations compare to each other? Which organization has demonstrated the kinds of outcomes we would like to see for the money we spend? What is the most cost-effective plan that provides the outcomes we want?" When payers can systematically compare outcomes for particular services across organizations,

they can select plans that best meet the care needs of their constituents and their own needs to purchase cost-effective services.

In this paper we summarize the issues involved in measuring outcomes of mental health services and in developing outcome measurement systems for the purpose of improving quality of care. We discuss the value and purpose of such measurement for individual consumers of services and for service delivery systems. We also describe current efforts to measure outcomes rigorously and systematically and highlight areas where work is needed in the future. We put before the experts a number of questions that form the framework for this analysis:

- Why should we measure outcomes?
- What are the key issues in developing an outcome measurement system?
- What are the key issues in implementing an outcome measurement system?
- What activities are currently underway in outcome measurement?
- Where should we direct our future efforts and resources?

Why should we measure outcomes?

“Some of the intended purposes of outcome measurement are to provide information for consumer choice among health plans, health care providers, or treatment alternatives; to design financial incentives to accomplish various cost containment, access, or quality-of-care goals; to identify areas in which quality of care should be improved; and to monitor and evaluate changes in policy or new treatments.”
(McGlynn, 1996)

In the context of mental health care, an outcome is the result of a medical, social, or psychological intervention. Although outcomes typically are discussed in regards to the quality of care, decreased cost or increased access are also desirable effects of an intervention. A positive outcome implies that an objective was achieved as the result of an intervention; a negative outcome implies that it was not. For individuals receiving mental health services, a positive outcome might mean improvement in the condition of those who received the services; a negative outcome, a worsening of their situation. For purchasers of services, positive outcomes might be that services cost less or that access to services increased. In short, we measure outcomes to determine whether our interventions produced a change and whether that change was in the direction we wanted.

Outcomes can be measured on two levels. On the consumer level, we measure the outcome of treatment for a particular individual to determine whether the intervention was effective for that individual. On the system level, we measure outcomes for entire populations to determine whether the services provided by a public mental health authority or a managed behavioral health care organization were beneficial to the community. In both cases, we are judging the quality of care by examining its tangible effects on the

actual recipients of care. We are not hypothesizing about what ought to work—we are actually measuring whether it does, in fact, work.

The shift to a public health model — to looking at the impact of care on a population — marks a major transformation in outcomes research. While the care of individuals remains important, other questions are equally important: Where do we stand with prevention? What happens to people who do not have access to services? What are the outcomes for people who receive no treatment?

By routinely monitoring outcomes, whether of the treatment given to an individual or of the way services are organized and financed, and by feeding back this information to the treatment providers and to the service delivery systems, both can evaluate their performance on a continuous basis and make improvements in the quality of care they provide. Outcome measurement establishes the value of what we do — and points to how we can do it better. (Burnam, 1996) “It is the degree to which that information is incorporated in the organization’s decision processes that reflects the utility and impact of outcome information.” The central purpose of outcome data is “to improve service planning and direct service delivery.” (Hernandez and Hodges, 1996; Hernandez et al., 1996)

By standardizing the measurement of outcomes, we can compare interventions and make choices among them—again, on both the consumer and system levels. If, for example, we compare the outcomes of treatment with medication alone or medication in combination with psychotherapy for a single consumer over time, both provider and consumer have the data they need to make informed decisions between treatment alternatives. Comparing outcomes of different interventions among consumers with the same disorder—and determining which interventions are associated with superior outcomes—enhances provider and consumer decision-making. It also allows public mental health authorities and other service delivery systems to wisely allocate their resources. Consumers also want to be able to compare the outcomes achieved by different providers so that they can effectively make choices among different caregivers. (Feldman, 1996)

Stakeholder groups have different reasons for wanting standardized outcome measurement. (Feldman, 1996) Employers and public payers need comparable outcome data to choose among health plans and make rational purchasing choices. Purchasers increasingly require managed care organizations to measure outcomes and use them to set performance standards and goals in their contracts; in negotiating benefit and premium levels, they want to know which services produce better outcomes—which ones are worth paying for, and how much.

Measuring outcomes ensures accountability. Purchasers and consumers expect providers, programs, and systems to monitor specific, measurable outcomes and demonstrate that they have accomplished what was expected of them. Indeed, “interest in outcome accountability is leading to discussion about the strategies that must be created in order to move systems from compliance-oriented data collection to outcome-based measure-

ment and from rule-driven decision making to decision making based on practical data.” (Hernandez and Hodges, 1996)

Measuring outcomes can be as simple as a provider regularly asking consumers to complete symptom check-lists and determining change compared to previous ratings. Or, it may involve extensive data collection from all providers and consumers in a service delivery system, computerized databases, and detailed reports on a variety of outcomes. A wide array of outcome measurement systems and software purport to meet any outcome measurement need. Our purpose is not to recommend particular instruments or ways of measuring outcomes, but rather to highlight the most important issues in developing and implementing outcome measurement.

What are the key issues in developing an outcome measurement system?

The key issues in outcome measurement include attention to differences among stakeholder groups; assurance of privacy and confidentiality; appropriate use and interpretation of data; standardization of outcome measurement; and technical considerations in designing an outcome measurement system.

Differences Among Stakeholder Groups

Consumers, families, providers, purchasers, and managed care organizations differ in what they consider to be the key areas or domains in which outcomes should be measured. (Campbell, 1996) Consumers, for example, see quality of life, functional status, and satisfaction with care as important domains whereas providers may emphasize symptom reduction, and family members may focus on welfare and safety. Purchasers and managed care organizations are often most interested in cost outcomes.

While there is a consensus on the value of many domains, there is less agreement on the indicators that characterize a domain and on the instruments to measure them. Consumers, for example, might want to see “independent living” as an indicator of quality of life, whereas purchasers might be more interested in an indicator such as “employment status.” There is often heated debate over which instruments most reliably measure any given indicator. Since it is important to limit the amount of outcome data collected and to standardize procedures, system developers cannot include all domains, indicators, and instruments—they must choose among them.

Consumer advocates argue that consumers are given too little say—not only in what counts as a desirable domain for measurement, but also in what counts as a successful outcome. They feel that this results from the erroneous assumption that care recipients do not know their own best interests. Advocates assert that what the consumer believes to be the crucial outcome—and whether it is achieved—are the key determinants of both satisfaction and compliance with treatment. For example, one study compared outcome

preferences of consumers, families, clinicians and administrators, and found that all groups considered symptom reduction an important outcome but differed on family involvement and safety. (McGuirk et al., 1994) Furthermore, as Campbell points out, the power of outcome data to affect changes in service delivery systems means that stakeholders will contend over the choice of domains, indicators, and instruments. She argues for a shift “toward a multistakeholder model based on collaboration [where] divergent views can be shared and reconciled ... [to] facilitate individual recipient choice.” (Campbell, 1996) Hernandez urges synthesis of cost and quality outcomes to maximize the quality of care within available resources. (Hernandez and Hodges, 1996; Hernandez et al., 1996)

The ideal system should meet the needs and interests of all constituencies. The domains, indicators, and instruments will, inevitably, reflect the values of those involved in the selection process. Bias will be minimized by including all stakeholders in this process and by making a conscious effort to be value-neutral. If stakeholders are to find outcome data relevant and accessible, they need to be actively involved in choosing the domains and indicators to be studied, selecting the instruments and methods of assessment, and elucidating the meaning of the results. Such involvement promotes culturally competent decision-making in planning and delivering services.

Campbell finds the multistakeholder approach exemplified in models developed in industry and marketing. Total Quality Management, with its goal of satisfying the customer, first finds out what the customer wants through surveys, focus groups, consumer councils, complaint tracking systems, and test marketing; and then uses customer feedback in an iterative process of Continuous Quality Improvement. The Constituency-Oriented Research and Dissemination (CORD) model developed in 1992 by the National Institute of Disability and Rehabilitation Research (NIDRR) ensures consumers a role in identifying needs and setting priorities: consumers participate in writing requests for proposals, preparing applications, peer review, making awards, conducting projects, disseminating results, and conducting evaluations.

Assurance of privacy and confidentiality

A major challenge facing all stakeholders, but particularly the consumers, families, and providers who are the “subjects” of outcome measurement, is to assure each person’s right to privacy and to maintain the confidentiality of all data that are collected. Critics of outcome measurement argue that the threat to personal privacy that exists when sensitive information is stored on an individual has not yet been outweighed by systematic demonstration of the value of collecting and analyzing outcome data. As Gellman and Frawley (1996) write, “One of the myths of modern medicine is that health records are confidential and highly privileged. The truth is that legal protections for health records are incomplete and inconsistent, that medical ethics are inadequate to address confidentiality in the modern health delivery system, and that new technology and changing administrative

patterns are undermining whatever limited protections exist. Demands for nontreatment uses of identifiable healthcare information are escalating and weakening the ability of patients and providers to know how information is being used and disclosed."

These authors point out that there is no general Federal law that provides for the confidentiality of health records except for those in facilities operated by Federal agencies or Federally funded for alcohol or drug treatment programs, and that state laws vary enormously in scope, quality, and applicability to current practices. Even though all providers are bound by codes of ethics to protect the confidentiality of a consumer's communications, there are no explicit guidelines on what information can and should be passed on to insurers, researchers, utilization and peer reviewers or—outcome system managers. Furthermore, these codes of ethics do not extend to personnel who, day-to-day, typically have access to private information such as secretaries, administrators, claims and other data processors, and computer system operators, or to individuals to whom information has been appropriately transferred. (Institute of Medicine, 1994) It is not only the well-documented cases of fraudulent trafficking in health information that are of concern, but the simple fact that "computers and networks increase the number of people who can access the information, the centralization of data, and the risks from breaches in security." (Gellman and Frawley, 1996)

Still, proponents of outcome measurement would insist that we should find solutions to these problems and not simply abandon efforts either to improve the quality of care by collecting data on consumer outcomes and system performance or to increase our understanding of mental illness and its treatment by aggregating these data to study population trends or services utilization. A comprehensive discussion of issues of privacy and confidentiality is beyond the scope of this paper, but several key principles should underlie development and implementation of any outcome measurement system. Above all, those who collect and store data should be held accountable for ensuring that:

- the existence of an outcome measurement system, or other record-keeping system, its purposes and use, is public knowledge;
 - individuals are able to review, revise, or remove any information about themselves;
 - data are collected only with the knowledge and informed consent of the subjects;
 - data are accurate, complete, timely, and used only for the purposes and by the persons approved by the subject; and
 - data are secure from loss and from unauthorized access, use, or disclosure.
- (Bennett, 1992)

Designers of computerized outcome measurement systems must develop the technical procedures and mechanisms to facilitate appropriate use of data (e.g., only 'need-to-know' users and 24-hour user support); prevent unauthorized access to data (e.g., unique passwords or other user identifiers, system locks, ability to recognize inappropriate access, automatic

log-off); maintain data integrity and security (e.g., verification procedures, maintenance procedures, automatic back-up systems, disaster-recovery procedures); and educate and continuously monitor users (e.g., user-training programs, enforced policies against sharing passwords, audit trails, data transfer monitoring). (Gellman and Frawley, 1996)

Appropriate Use and Interpretation of Outcome Data

Just as all stakeholder groups are concerned about the privacy and security issues involved in data collection, storage, and transfer, they also insist that if valid conclusions are to be drawn from outcome data, the information must conform to the highest methodological standards and be interpreted with care and sensitivity.

Outcome assessment in clinical settings is naturalistic. Unlike studies that randomize subjects to treatment groups or use placebo-controlled, double-blind procedures outcomes, data gathered in clinical settings do not “prove” anything; instead, they suggest hypotheses that can be tested under more rigorous conditions.

How outcome data are reported affects their usefulness. The information must be accessible to all types of users in both format and language. Reports should use non-technical terminology and address issues relevant to different users’ needs. They should include explicit statements about what the data do and do not mean. For example, reports should make clear that mental health outcomes are complex phenomena, the result of a great many events and circumstances, and that there is rarely a simple and direct link between an intervention and a particular outcome. Too often data are presented in ways that are misleading and confusing and do not clearly spell out the implications for policy- and decision-making.

To the extent that outcome data are used as marketing tools, it is critical that we be aware of the potential for misinterpretation and consider the factors that could bias the results. For example, when reviewing outcome data, readers should ask themselves these questions: What are the characteristics of the population under study? How was the sample selected? What instruments were used and how reliable and valid were they? What rate of follow-up was achieved? What statistical tests were used? What do the investigators really mean by a “good” or “successful” outcome? Those who use outcome data must become informed consumers of this information in order to use it wisely. (Erdlen, 1992)

Standardization of Outcome Measurement

If outcome data are to facilitate comparisons — whether among treatments, programs, providers or plans — it is necessary to measure the same outcomes in the same way. For example, it would be meaningless to compare managed behavioral health care plans in terms of readmission rates if one plan counts admissions that recur within one month and another counts those that recur within two months of the original hospitalization. Similarly, comparisons across programs must adjust for the types of disor-

ders and severities of illness in the different populations. Until the field develops "high-quality normative data that can be used to make comparisons and to benchmark system outcomes against national or regional norms providers, payers, and consumers cannot determine whether performance of any mental health care system is average, or above or below average." (Steinwachs et al., 1996) Such data depend on having standardized and uniform data collection tools and methods and willingness to use them.

The need for standardization also applies to describing service recipients and providers, clinical conditions, and therapeutic procedures. Providers and payers use the terminology and diagnostic criteria in the American Psychiatric Association's Diagnostic and Statistical Manual (American Psychiatric Association, 1994). Consumer advocates, however, note that diagnostic labels overshadow more essential qualities of a person and correspond to a medical model of illness rather than a model of recovery. We lack terminology that incorporates both points of view. Similarly, we need uniform descriptors that accurately portray the types and intensity of services and the full range of settings in which they are delivered (e.g., community mental health clinic, school, prison, home).

Because developers of outcome measurement systems generally select instruments they know and like, there are no standardized approaches to measuring outcomes in any domain—even though there are many reliable and valid instruments from which to choose (see Table 1). We cannot compare an outcome even as seemingly simple as the presence or absence of depression when we use different instruments to measure it. There are, literally, hundreds of instruments. Narrowing the options to commonly accepted psychometrically sound measures such as the examples is a first step toward finding agreement on a core set of instruments.

Standardization does not preclude using special assessment methods and instruments for distinctive populations. For example, accurate measurement of outcomes for children and adolescents requires special interview techniques and instruments that address relevant issues such as school performance. (Epstein et al, 1996; Outcome Roundtable for Children and Families, 1998) People with psychotic disorders and cognitive impairment may need help reading and understanding written questionnaires.

Technical Considerations in Designing an Outcome Measurement System

Public mental health authorities, managed behavioral health care organizations, providers, and consumer groups are forging ahead with developing outcome measurement systems. This is an expensive undertaking, however, and the array of available computerized systems and assessment instruments is overwhelming. Too often groups are so eager to begin that they select tools before they develop the conceptual foundation for their systems. It is only after users decide what it is that they want to know, that they can proceed wisely with technical matters.

Developers must begin with determining why they want to measure outcomes. A day treatment program, for example, wants to know whether its new psychotherapy group

is effective. A consumer-run social club wonders whether its outreach activities increase participation. A public mental health authority expects its managed behavioral health care vendor to show whether it has met its contractual obligation to increase access to services. Providers in a health maintenance organization want to compare the effectiveness of two different treatment modalities before endorsing one of them in its clinical guidelines. Depending on the objective, developers will need to decide whether to use disorder-specific outcome measures or generic instruments; measure outcomes in an entire population or only a sample; assess a particular condition or all disorders; or use brief assessments or more complex multidimensional ones.

Experts agree that the ideal outcome measurement system uses both generic and disease-specific measures and collects both quantitative and qualitative data. Sampling and brief assessments are the least costly approaches. Focusing on particular conditions reduces the burden of assessment and sharpens the assessment. Indeed, it is often possible to generalize results from one condition to the entire system of care "since most of the findings concerning the processes of care and the outcomes of care are system rather than clinical issues.... For example, if proper prescribing of psychotropic medication is a problem for physicians who are treating people with anxiety disorders, it is likely to be problematic in the treatment of mood disorders as well." (Smith, 1996)

The system should thoroughly and objectively determine the process of care: types of treatment, frequency of contact, and intensity of involvement. Outcomes should also be assessed for people who are not treated, i.e., people who leave treatment prematurely or who do not have access to care at all. The analytic techniques and statistical procedures should address any problems in sample size and bias, and manage the complex relationships between processes of care and outcomes (Burnam 1996). Finally, interpretation must avoid unsupportable claims that an intervention caused an outcome because these are not controlled intervention studies. The big question—Which outcome measurement method is best?—has no answer: "The options surrounding data collection are numerous, but there are no data to support one method over another." (Smith, 1996)

What are the key issues in implementing an outcome measurement system?

Even if the ideal outcome measurement system could be designed, implementing it in the real world remains a formidable challenge. Experts recommend several steps in implementation; each one requires thoughtful consideration and careful planning. (Smith, 1996; Hernandez and Hodges, 1996; Steinwachs et al., 1996; Kramer, 1995; Kramer and Smith, in press)

Build consensus on accountability. The political climate can make or break an outcomes system. People and organizations are not willingly or easily held account-

able—even when they sincerely believe that accountability is important. There must be a strong commitment at all levels to develop and maintain an outcome measurement system, and to use it both for accountability and quality improvement.

Define objectives. A hospitable political climate depends on establishing a common vision of the purposes of measurement, the outcomes to be assessed, and the roles of participants. Identify key stakeholders early on and engage their input through surveys and focus groups. Clarify leadership and responsibilities from the beginning; define the “customers” of the outcome measurement system and clarify what they want to learn from outcome measurements.

Spend time planning. The more time spent planning the outcome measurement system, the more effective it will be. Planning should begin with defining objectives: will the system be used to improve quality, to meet reporting requirements, or to study the impact of innovative treatments? (Zieman and Kramer, 1996) Planning should be realistic and attend to cost, training, and staffing. Experts encourage talking to people involved in outcome measurement, seeing “what’s out there,” and learning from the work of others. They also recommend starting small and then expanding. Developers should pilot test their instruments and procedures and make revisions as necessary. The Texas Children’s Mental Health Plan, for example, was initiated in five sites, then 16, and only after that was rolled out across the whole state. Implementation should be gradual, benefiting from the knowledge gained at each step along the way.

Gain provider, staff, and consumer cooperation. Unless providers, office staff, and consumers are committed to outcome measurement, it will not succeed. It is a burden to complete questionnaires and rating scales, enter data, and track clients. Successful involvement of key participants can be achieved by engaging them from the beginning, by enlisting their help in designing, planning, and implementing the system and when accountability is part of the ethos of an organization. Administrators may need to offer incentives to complete forms (e.g., payments, bonuses, dissemination of collection rates) and should ensure that participants understand the value they will receive from the data.

Guarantee the place of consumers. Information regarding the experience of consumers and families should be collected directly from them, rather than from providers or administrators. Values and experiences vary widely among consumers and systems should include the range of domains and indicators important to different individuals. Data on physical, mental, and social functioning is more meaningful and useful when it is combined with information on consumer satisfaction.

Select appropriate domains, indicators, and instruments. Experts note that in discussions of outcome measurement they are often asked to recommend particular instruments. While they agree this is an important question, it is premature unless conceptual issues are addressed first. The most basic issue is to reflect the needs of those served by that system in the outcome domains and indicators selected. Hernandez proposes the following questions to guide selection:

- Is the information useful to administrators, providers, and consumers?
- Do the outcomes create opportunities for corrective action?
- Do they support achievement of cultural competence?
- Does the indicator specify the outcome and can it be easily measured?
- Does the instrument provide valid and reliable information about the outcome?
- Can data collection and reporting be sustained?
- Is the level of respondent burden for both consumers and providers acceptable?

Pool data from a variety of sources. Combining data from many sources provides the most illuminating look at outcomes. Outcome data are best understood in conjunction with enrollment, encounter, and cost data so that the effects of treatment can be appreciated in the context of who received services, what the interventions were, and how much they cost. Other data sources include: administrative data from billing records to examine patterns of utilization and cost of services; clinical data from medical records to describe a person's functional status; surveys of consumers to address quality of life and satisfaction with care; and surveys of providers to show customary practices, job satisfaction, adherence to guidelines, and opinions and attitudes.

Establish clear procedures for collecting and analyzing data. Consumers, providers, and staff are not accustomed to the stringent requirements for accurate and complete data collection that researchers follow, and may not understand how important these are for having confidence in the data. Experts suggest collecting only essential data to minimize respondent burden and explaining why the information is needed and how it relates to the goals and purposes of the organization. Data elements should be well-defined and of obvious value. Participants should be carefully trained in their specific tasks (e.g., collecting, verifying, correcting, and entering data) and in retrieving the information they want from the system. Forms should be easy to complete quickly (e.g., online, touch-screen or scannable data entry) and reviewed immediately so that missing data can be tracked down. Data collection and reporting processes should be timely and predictable.

Use outcome data regularly. The value of outcome information will become most apparent if it is used on a routine basis—if it becomes part of the everyday life of the program or organization. Therapists, for example, can be trained to use outcome data in their assessments, treatment planning, and treatment program reviews. (Bergen-Seltzer, 1997) Outcome data can be discussed at clinical staff meetings and reported in newsletters to consumers as demonstrated by the LA County Outcomes Initiative.

Ensure that what is measured is what really occurred. What providers think they do and what they actually do can be quite different. Similarly, an outcome that a provider or consumer attributes to an intervention might, in fact, have occurred for another reason.

It is not enough simply to ask what services were delivered; rather, we need to determine the fidelity between what was intended and what actually happened.

Integrate outcome with other kinds of measurement. An important goal of current research in information systems is to integrate data collection and measurement activities. Outcome data should be used, for example, to develop practice guidelines, and, in turn, guidelines “can provide a standard against which current practices can be evaluated in order to improve outcomes.” (McGlynn, 1996). Outcomes measurement systems should be integrated with other approaches to assessing quality of care such as performance indicators and report cards—this will facilitate understanding of the relationship between the process of care and outcomes. Different kinds of data should be stored in compatible databases, databases that can be exported to a common system, or in virtual systems. (Manderscheid and Henderson, 1995) The ultimate goal is a fully integrated information system that combines enrollment, encounter, and cost data, health status, system performance measures, and consumer and system outcome measures.

Take action to improve services. The reason to measure outcomes is to have information to guide improvements in the quality of care. According to the Ecology of Outcomes model developed by Hernandez and colleagues (1996) “simply having outcome information does little to improve services if agencies and providers have no way of understanding outcomes in the context of who the system is serving or what services are being provided.” The service system and the accountability system must overlap and work together: “Understanding outcome information contextually is a prerequisite for the informed use of outcomes in decisions regarding service planning and delivery.”

What activities are currently underway on outcome measurement?

“The science of patient outcomes assessment has become increasingly precise and reliable in quantifying the elements of mental health and substance abuse treatment. Outcomes assessment is now being used to link people, both patients and providers, with various treatment approaches and the outcomes of those treatments in ways that can improve care and hold those who provide care accountable.” (Smith 1996)

Many mental health care programs and service delivery systems are now using outcome assessments. Providers, payers, and consumers are increasingly familiar with measurement tools and procedures and researchers are increasingly proficient in the science of outcomes. Work is progressing in formulating policies and standards, in developing and implementing outcome measurement and measurement systems, and in reporting data to consumers, providers, accrediting agencies and other stakeholders. Below we summarize some of the major accomplishments to date and the programs and activities currently in the field.

Formulating Policies and Standards

As discussed earlier, standardizing outcome measurement is important to its success and further development. The more uniformity in data collection practices and procedures there is across systems, organizations, agencies, and programs, the more the data can be shared, the less redundancy and overlap there will be, and the more useful the assessments will become for consumers, providers, and systems. At the same time, it is recognized that differences among entities in regard to goals, services, populations served, and resources will mean that outcome systems will also differ as they are tailored to meet each entity's particular needs and characteristics. Therefore, public and private organizations in leadership positions in mental health services have supported efforts to establish policy and set standards for outcome systems. In this way they hope to guide system development along a uniform path to ensure adherence to sound principles and compatibility among different systems.

For example, the National Alliance for the Mentally Ill (NAMI), the Center for Mental Health Services (CMHS), the National Institute of Mental Health (NIMH), the National Institute on Alcohol Abuse and Alcoholism (NIAA), and Eli Lilly have jointly sponsored the Outcomes Roundtable, a multidisciplinary and multistakeholder group whose work began in late 1994 with a national meeting that set up three task forces: one to formulate principles and recommendations for outcome measurement; another to develop standards for outcome measures that are accurate, affordable, and practical and for methods of sampling, follow-up, data collection, and analysis; and a third to disseminate findings to consumers, families, providers, payers, managed care organizations, policymakers and the general public. (Shern and Flynn, 1996; NAMI 1996; Smith et al., 1997) Similarly, in the fall of 1996, CMHS convened the Adult Outcome Measurement Standards Committee to address methodological standards for outcome measurement systems. This group has defined key terms, identified salient issues, and suggested standards for design, quality, and measures. (Adult Outcomes Measurement Standards Committee, 1997) In the same vein, the American College of Mental Health Administration (ACMHA), having determined to offer itself "as a neutral forum for development of consensus on challenging issues facing the field of mental health and substance abuse treatment and prevention," devoted its first summit meeting in 1997 to outcome measurement. Representatives of leading national stakeholder organizations drafted value statements and recommended key indicators and measures for outcome assessment. (American College of Mental Health Administration, 1997)

The consumer perspective on policy and standards has been articulated by The Consumer/Survivor Mental Health Research and Policy Work Group. This group, with support from the National Association of State Mental Health Program Directors (NASMHPD) and CMHS, convened two consumer focus groups (using concept-

mapping technology) to discuss system reform, research, and evaluation. The groups concluded that "traditional mental health systems pathologize problems in living, hold low expectations of consumer achievement, are paternalistic, offer a limited range of options, and are too quick to define anger as symptomatic....researchers fail to ask questions that capture adverse or negative effects of treatment and care or outcomes such as recovery, personhood, well-being, and liberty." (Campbell, 1996; Trochim et al., 1993) This group also identified important domains in which consumer outcomes should be measured: "legal issues, consumer impact on service delivery and system development, oppression and racism, healing and recovery, coercion and control, personhood, damaging effects of treatment, alternatives to traditional services, citizenship, quality of life, employment, and validity of research." (Campbell, 1996)

Similarly, principles and standards for outcome assessment of children and adolescents has been the focus of the Outcome Roundtable for Child Services since October 1996. (Epstein et al., 1996) While the Roundtable recognized an urgent need to add outcomes to managed care's limited concern with cost and length of stay, it also understood the need for a conceptual framework for understanding outcome-based accountability: unless outcomes were placed within that framework, "there was a risk that information would be obtained solely on the attainment of specific outcomes, and that such information would be subject to misinterpretation." (Outcome Roundtable for Children, 1997) Therefore, rather than identify or develop indicators and measures, the Roundtable began to develop a conceptual model and to "identify research and evaluation based criteria ... for selecting outcomes ... [and] criteria about other types of information that should be collected in order to better interpret results and support continuous quality improvement." (Epstein et al., 1996) For example, they identified three domains that had to be described and linked together to provide a framework for data on specific outcomes: the children and families to be served (the population), the desired outcomes for them, and the intervention(s) developed to help achieve the outcomes. The group also recommended that data should be collected by a variety of methods (e.g., self-administered surveys, focus groups, interviews, standardized questionnaires), from multiple sources (e.g., children, parents, direct service workers) in multiple systems (e.g., health, education, child welfare, juvenile justice), and across many domains for both the child and the family (e.g., functional status, symptoms, physical health, cultural and ethnic background, educational achievement, life/work skill development, emotional functioning, safety, social life, stability/permanence of living arrangements, satisfaction with services, empowerment/decision-making, and quality of life). They also noted that interpretation of results should include multiple stakeholders and that information users at all levels should be trained in the use, scope, and limits of outcome data, particularly for purposes of quality improvement.

At its 1997 Santa Fe Summit the American College of Mental Health Administration also addressed the unique methodological issues of measuring outcomes for children

and families. A Child Outcomes Work Group drafted a report on basic principles, indicators, and measures.

Developing and Implementing Outcomes Systems and Reporting Outcomes Data

Activities are also underway to identify specific outcome measures, develop and implement outcome measurement systems, and report and use the information from these systems. Attention is also being paid to evaluating the effectiveness of these efforts and learning how to improve the process.

CMHS has sponsored several projects aimed at identifying outcome measures. These include work on developing measures that are brief and easy to use such as the Medical Outcomes Study Short Form-36 (SF-36), the Behavior and Symptom Identification Scale (BASIS-32), and the Global Assessment of Functioning Scale (GAF) and on an outcomes tool kit to help providers and programs develop outcomes assessment systems relevant to their particular needs. (Human Services Research Institute [HSRI]) ACMHA, in its report from the 1997 Summit mentioned earlier, recommended a set of outcome indicators and measures for both adults and children. The report recognized the debate in the field about the efficacy of different instruments and chose measures on the basis of their manageability (relative ease of collecting and analyzing data), measurability (capacity to provide quantifiable and comparable data), and meaningfulness (relative utility to facilitate decision-making).

Many states now use outcomes measurement to help them decide what services to provide. Maryland, for example, used outcomes data to help answer questions about the impact of treatment for schizophrenia, to compare its treatment outcomes with those of other states, and to compare outcomes across the state. Arkansas compared outcomes associated with differences in accessibility of community services. (Steinwachs et al., 1996)

It is also essential to evaluate outcomes and use this information to modify and improve them. The Outcomes Roundtable task force on standards and data collection, for example, is studying the capacity of providers to collect outcomes data on a routine basis, the financial and organizational obstacles to implementation, and the impact of outcome information on consumer care choices. (Shern and Flynn, 1996) In 1997 the Roundtable applauded five exemplary outcome measurement projects: the Arkansas Medicaid Administrative Project (MAP), the Outcomes Management Project (OMP), the AT&T Employee Assistance Outcomes Management System, the Colorado Health Networks (CHN), and the McLean Hospital Project. (Silverberg, 1998; Smith, 1998; Jordahl, 1998) The Michigan Outcome Identification Project is also noteworthy for its measurement of a diverse set of outcomes for children.

Important lessons have been learned from these projects. First, the MAP, for example, found that unless clinicians believed strongly in the importance of the project, they tended

not to refer clients into the outcome measurement system. Second, retaining clients in the system varied with how attached clients were to the service delivery system. (Silverberg, 1998) Third, intensive stakeholder involvement (particularly providers) is a key to success, as shown by the CHN outcomes system. Meeting monthly from the beginning of the project, a committee of consumers, family members, providers and payers helped determine what outcomes would be measured and participated closely in interpreting and disseminating the data. Providing regular feedback to providers on both an individual and organizational level and comparing their outcomes to national norms and to peers' outcomes also strengthened their participation (Smith, 1998) Minimizing the burden on providers by incorporating the requirements of the outcome measurement system into their customary daily activities (as in the AT&T Chemical Dependency Outcomes Management System) was instrumental in provider satisfaction and compliance. Finally, for all consumers with complex problems, but particularly for children, outcomes should be measured in a wide variety of settings including schools, juvenile justice programs, and out-of-home placements and should examine factors other than treatment per se that could influence outcomes such as poverty, comorbid conditions, family functioning, social support, and adherence to treatment.

Where should we direct our future efforts and resources?

The panel of experts recommended a general approach to developing and implementing outcome measurement systems and offered specific suggestions.

Demonstrate the value of outcome measurement. From a common sense perspective, the experts noted, there is reason to believe that measuring outcomes can improve the quality of care although solid research-based evidence is lacking. Scientific study of the impact of outcome measurement on the quality of care is essential.

Proceed thoughtfully and systematically. Outcomes measurement is becoming a big industry: Everyone wants outcome data, has a favorite instrument, and tries to influence systems to produce data. Providers and consumers are increasingly asked to provide information without knowing why and without seeing the results. Thoughtful reflection, careful planning, and open discussion of all issues are needed before investing valuable resources.

Standardize and integrate from the beginning. Outcomes should be integrated with other kinds of measurement and data collection efforts: report cards, performance indicators, and enrollment, encounter, and cost data. Outcomes should be used to guide development of clinical practice guidelines, evaluate their effectiveness, and inform revisions. Developers of outcome measurement systems should ensure that their systems are compatible with those of other programs and agencies through collaboration and communication, sharing resources, and inclusion of all stakeholder groups.

Should outcomes measurement be mandated? Can standardization happen if particular methods and instruments for measuring outcomes are not mandated? If standards are promulgated, will organizations follow them? How will compliance be monitored? Some experts suggested that governmental authorities should set overall requirements and standards; others recommended writing into contracts, on a case-by-case basis and with clear incentives, the expectation that providers and managed behavioral health care organizations conduct outcome assessments and use them to improve the quality of care. Still others argued that it is primarily a matter of educating communities and organizations to recognize the importance of outcome measurement.

Include consumers at all levels of planning and implementation. Meaningful discussions among stakeholders can only proceed if all groups are at the table; if language is non-technical and readily understood by everyone; and if the outcomes studied are relevant to all constituencies. Outcome data alone are not enough to guide decision-making: there must also be ongoing conversations among stakeholders to interpret the data, understand its implications, and decide how to use the information. An outcome measurement and accountability system cannot operate successfully unless there is 'buy-in' from all those affected.

Ensure scientific rigor. Although outcome systems (as opposed to outcomes research) are practical, real-world tools for providers, consumers, and administrators of mental health care services, the experts urged developers to make use of what has been learned through experimental study. This includes choosing reliable and valid assessment instruments, using appropriate sampling and statistical methods, and adhering to accepted canons of interpretation. There are dangers in misrepresenting the meaning of outcome data. Although a variety of domains and indicators are considered relevant to outcomes measurement, and although there are many good instruments available, experts cautioned developers to understand better the real meaning of these domains, identify overlap and gaps, and determine whether indicators and measures accurately and completely address the issues.

Use outcome data carefully. Experts highlighted the value of outcomes data for improving treatment programs. They cautioned, however, that before investing heavily in program and system changes, stakeholders needed to carefully consider the limitations of the outcome analysis: Were observed changes (e.g., in symptoms and level of functioning) significant and meaningful? Was the follow-up period long enough? Did the study adequately describe the process of care, the nature of the services, and the characteristics of service providers and recipients?

Ensure ethical rigor. The field should develop explicit ethical guidelines and standards for organizations to ensure the integrity of outcomes data and the privacy of the individuals from whom the data were collected. It is essential to include all stakeholder groups in this process.

Expand the focus of outcome measurement. It is time to identify outcome measures and develop outcomes systems for special groups of consumers, including children, geriatric, and culturally diverse groups. Special attention is needed to develop measures for consumers with complex conditions such as combined mental illness and substance abuse or medical conditions.

Conclusion

Outcome measurement provides important opportunities for improving the quality of care for people with mental illness and their families—if measurement systems meet the needs and interests of all stakeholders, if data are collected and analyzed according to rigorous scientific standards, if information is accurately reported in ways accessible to all users, if outcome assessments are culturally relevant and ensure the privacy of all persons on whom data are collected, and if outcomes are integrated with clinical guidelines and other measures of clinical and system performance.

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Mental Health Report Cards

**Meryl Friedman, Sarah Minden, John Bartlett, Vijay Ganju,
William D. Gettys, Marilyn J. Henderson, Caroline Kaufman,
Ronald W. Manderscheid, Margaret O'Kane, John Pandiani,
L. Gilberto Romero, E. Clarke Ross, Deborah Teplow**

The Role and Value of Report Cards

Report cards are tools for measuring the performance of health care systems and providers. They allow for the evaluation of specific aspects of performance including, but not limited to, quality, access to services, consumer satisfaction, cost-effectiveness and consumer outcomes. Report cards may include performance measures of the structures of an organization (e.g., the existence of a quality assurance committee), the processes by which it functions (e.g., its methods to ensure review of, and compliance with, guidelines for care), and the nature of the outcomes of the care it provides (e.g., improvement in a person's ability to function).

At present, there is no consensus on what constitutes a "good" report card. There is agreement, however, that report cards have positive value and play an important role in fostering the public accountability of managed care organizations. Report cards should address issues that are measurable, specific, and relevant to the needs of consumers and purchasers of services.

Ideally, report card data should compare the performance of managed care organizations to each other and compare an individual organization's performance to established standards—either those that experts agree are "best practices" or those that research has shown to be associated with desirable outcomes. Standards should be evidence-based and unequivocally related to improving patient care.

It is important to distinguish between report cards and performance measurement data sets. Performance measurement data sets, from which report cards evolve, are broader in scope and typically used by accreditation agencies to evaluate managed care organizations. They are also used by the organizations themselves to improve their performance. Report cards, by contrast, are aimed at consumers and purchasers of care to help them judge the relative performance of managed care organizations and choose among them. For example, while the Health Plan Employer Data and Information Set (HEDIS) developed by the National Committee for Quality Assurance (NCQA) includes a wide variety of performance measures that evaluate many aspects of a managed care organization's performance, it is not published in a format that facilitates comparisons between organizations, and, therefore, is not a report card. Compared to performance

measurement data sets, report cards contain fewer measures, address issues of particular relevance and interest to consumers and purchasers, and present data in a more user-friendly format.

Report cards, however, may be generated from performance measurement data sets. Indeed, there have been efforts across the country, such as that by the New England HEDIS Coalition of health plans and purchasers in New England, to publish data from performance measurement data sets in report card formats that are easy for non-specialists to understand and that allow for comparisons across organizations.

The Current State of Report Cards

In both the public and private sectors, major initiatives are underway to develop report cards. In collaboration with the Center for Mental Health Services (CMHS), the Mental Health Statistics Improvement Program (MHSIP) established a number of task forces to address issues of measuring performance. In 1994, the Task Force on the Design of the Mental Health Component of a Health Plan Report Card under National Health Care Reform (MHSIP, 1993; MHSIP, 1994) developed a comprehensive set of performance measures that emphasized consumer-oriented issues; a second task force was convened in 1995 to further refine the report card. The MHSIP report card addresses key dimensions or domains of care including access, appropriateness, outcomes, prevention, and consumer expectations; it includes outcome measures, is research-based, and tries to minimize cost and respondent burden (MHSIP, 1996). MHSIP's work differs from other report card efforts in its clearly articulated values and emphasis on concerns related to serious mental illness. Its orientation toward consumers is unique in report card efforts, since most performance measurement systems are designed for managed care and provider organizations and for purchasers of services.

The American Managed Behavioral Healthcare Association (AMBHA) is a professional association comprised of leading managed behavioral health care organizations that collectively provided managed mental health and substance abuse services to more than 80 million people in the United States in 1995 (AMBHA, 1995). AMBHA developed a report card to establish an industry-wide database for policy and benchmarking purposes and to facilitate performance evaluation of its member organizations (AMBHA, 1995; Panzarino, 1995). This measurement system, known as PERMS — Performance Measures for Managed Behavioral Healthcare Programs — reports on three domains of care: access, consumer satisfaction, and quality. In addition, AMBHA stated three key principles for creating report cards: measures have to be meaningful, measurable, and manageable. AMBHA sees report card development as an active, ongoing work-in-process rather than a one-time effort.

The National Alliance for the Mentally Ill (NAMI) recently published a report card

for managed behavioral health care organizations (Hall et al., 1997). NAMI developed standards for critical components of a system of care for treating and managing serious mental illness, and surveyed managed care organizations to assess their performance in each area: treatment guidelines and practice protocols; intensive case management according to the Program for Assertive Community Treatment model; access to the newest, most effective medications; response to suicide attempt; involvement of consumers and family members; outcome measures and management; rehabilitation; housing. The report card presents the responses of nine managed behavioral health care organizations to the survey and concludes that managed care has failed in its promise to provide "a truly accountable, comprehensive, community-based system of care." (Hall et al., 1997) The report also expresses concern about the treatment of persons with severe brain disorders. The authors of the report acknowledge its limitations noting that there were no site visits, no assessment of consumer outcomes, and that the survey was the only source of information.

The work of influential national organizations such as NCQA, and development and refinement of performance measurement data sets such as HEDIS, create a culture that supports measurement and continuous quality improvement, and thereby facilitates report card efforts. In such a culture, limitations and obstacles to high-quality care are seen as opportunities for change rather than "mistakes" or "defects." Large-scale performance measurement efforts ensure development of the infrastructure and technical capabilities to conduct both organizational and consumer-oriented measurement activities in an efficient and cost-effective manner. Therefore, it is encouraging that NCQA, originally focused on measuring general health care services, has now begun to measure the performance of plans that deliver mental health and substance abuse services and to add mental health and substance abuse indicators to HEDIS. For example, NCQA has completed approximately eight mental health reviews. Rather than accreditation reviews, these evaluate an organization's processes in regard to access to and availability of mental health services and triage. In addition, NCQA has formed a Behavioral Health/Substance Abuse panel that includes representatives from both the public and private sectors to address issues in evaluation of access to, appropriateness of, and outcomes for mental health care. To date, 21 behavioral health/substance abuse indicators have been identified, and six to eight measures for these indicators will be incorporated into HEDIS 1999. Specific measures under evaluation include adequacy of pharmacotherapy, provision of family and social support services to families with adolescents with mental health or substance abuse problems, and member satisfaction with mental health services.

Performance measurement data sets can be a useful starting point for developing consumer- and purchaser-oriented report cards. For example, the Agency for Health Care Policy and Research sponsored development of the Consumer Assessment of Health Plans (CAHPS) which built on NCQA's annual members survey that was part of HEDIS

3.0. CAHPS is “an easy-to-use kit of survey and report tools that provides reliable and valid information to help consumers and purchasers assess and choose among health plans.” (Agency for Health Care Policy and Research, 1997) Although not specific to mental health care, it is an exemplary system that “yields results that are applicable to all plan types [and] a wide range of respondents”; presents information in “clear and easy-to-understand formats” through reports that “educate consumers about making health plan choices and guide them through the decisionmaking process”; “can focus on results that are of personal interest”; and includes free technical assistance for users.

Other large groups of providers, employers, managed care organizations, and researchers have combined efforts to produce performance measures that may affect development of report cards. These include the Consortium Research on Indicators for System Performance (CRISP) initiative, the Foundation for Accountability (FACCT), the Employee Health Care Value Survey (EHCVS), the HMO Quality Assessment Consortium, and the Medicare HMO/CMP Review Performance Measurement (MHSIP, 1994). Individual health plans have begun disseminating the HEDIS measures or their own consumer report cards; local coalitions of employers and consumer organizations have developed standards and published guides that compare performance of physicians, managed care organizations, and hospitals (National Health Policy Forum, 1994).

Issues Related to Developing Report Cards

The key issues that affect mental health report card development efforts include standardization, confidentiality, interpretation of data, and consumer choice.

Standardization

Standard data definitions, uniform data collection procedures, and accepted analytic methods are essential if comparisons across managed care organizations are to be valid. For example, to compare outpatient follow-up rates after hospitalization, data must be collected on populations that are similar with respect to demographic and clinical characteristics and be based on a uniform definition of “follow-up” (e.g., the specified length of time between discharge and first outpatient visit). Similarly, for comparisons of utilization, treatment retention, or outcomes, populations at-risk and populations receiving services must be defined consistently across organizations.

Some expert panelists argued that report cards will not be of much use until there is a uniform data infrastructure consisting of a minimum set of data elements, standardized data collection specifications, and analytic guidelines. Others felt that there is value in beginning to collect and use data now, before we have comparable measures and rigorous methods, because, at the very least, we will be moving these complex and difficult measurement efforts forward. They believe that using some simple measures now

(e.g., estimating access to services by asking consumers whether they were able to obtain the services they needed) is better than using none at all.

Panelists commented that critics of report cards insist that measuring the quality of mental health services is more subjective than evaluating the quality of physical health services and that it is much more complicated to assess the impact of psychotherapy than it is to determine the outcome of a surgical procedure. They responded that objective measures for mental health care do, in fact, exist and that new ones are continually being developed. They pointed to psychiatric hospitalization rates, mortality rates, and percent of providers who utilize and conform with mental health practice guidelines as examples of objective measures, and noted that the mental health field leads other areas of medicine in its standardized symptom rating instruments and diagnostic interview schedules. Panelists also indicated that there is value in asking a question as elementary as whether a person felt that he or she functioned better as a result of treatment.

Gelber and Duggar (1995) have sounded a warning: "the uncontrolled proliferation of report cards and performance standards...threatens to become a torrent that could drown both the managed care systems themselves and the consumers who are the intended beneficiaries of the standard-setting initiatives." Instead, the present situation offers the opportunity for greater dialogue among stakeholders and consensus-based development of uniform and standardized approaches.

Confidentiality

Confidentiality is a critical issue for both consumers and providers. Many consumers are concerned that information they reveal about themselves may at some time be "used against them" by a managed behavioral health care organization, insurance company or health care provider. As a result of such concerns, consumers may limit what they disclose. Even where no breach of privacy is intended, when sample sizes are small, advocates point out, there is a real possibility for determining a single individual's identity. (Ziglin, 1993; Ziglin, 1995)

The need for confidentiality, however, must be balanced with the need for information. Without collecting data to measure performance, we cannot hold managed care organizations and service providers accountable for their practices or determine where and what kind of improvements are needed. Therefore, although there is some risk to privacy with any disclosure, many consumers and advocates feel that it is warranted—if appropriate procedures are established to ensure the confidentiality and security of the data—given the importance of obtaining data that supports informed choices and enhances accountability.

Interpretation of Data

Accurate interpretation of report card data requires attention to background information on the population and organizations being studied. It also requires technical data

analytic skills, commitment to scientific rigor, and inclusion of the perspective of all stakeholder groups in the interpretive process. Analysts must clearly inform users of the strengths and limitations of the data and avoid exaggerated or misleading claims. They must not draw conclusions about aspects of quality that are beyond the scope of the particular measures used in the report card. Report card data should indicate clearly which aspects of care are being measured. Experts agree that “bellwether” measures that support conclusions about quality more generally would be valuable, but such measures do not currently exist for mental health services.

Report card users, themselves, need to be educated to use this information wisely — to know what conclusions can be drawn from the data and what cannot. For example, users should recognize that at the current stage of development of performance indicators, it is impossible to attribute specific consumer outcomes to the delivery of particular services: many factors can influence an individual’s response to treatment.

Consumer Choice

As use of report cards increases, consumers will become aware of data on managed care organization options that are not available to them. Consumer representatives have been frustrated when presented with report card data on organizations that are not offered by their employers or government purchasers that perform better than available choices.

Needs of Different Constituencies for Report Cards

Several constituencies require report card data: consumers, families, managed behavioral health care organizations, providers, and public and private purchasers of care. Depending on the constituency, different types of performance indicators and analyses are needed.

Some experts noted that because constituencies vary in their needs for and use of data, it is difficult to develop a report card that would be useful to all audiences. Others felt that all constituencies are concerned with the same issues of quality, cost and outcomes, and, although the emphasis may depend on the needs of a particular group, the common concerns could be addressed in a single report card. One solution, they agreed, however, was to develop a core set of items for all groups that could then be expanded by adding questions or measures to address particular concerns or issues. It is important, then, to understand the uses of report card data by different constituencies and to think creatively about how to provide each one with the essential data it needs.

Consumers and Families

For consumers and families, report card data provide information on plans and providers to allow for informed selection among alternatives. In addition to choice among

plans, report card data can be used by consumer and family advocates to negotiate and press for improved access to services and quality of care within plans. Report card data showing outcomes compared to benchmarks, or to outcomes obtained by other plans, provide consumers, families, and purchasers with the information they need to focus and support their positions in contract and benefit negotiations and in monitoring performance. The data, in turn, guide the plans toward the kinds of changes in access and quality that consumers and purchasers want.

Routine use of report cards is both supported by and reinforces accountability of managed care organizations and providers; it encourages quality improvement. Advocates assert, however, that some report cards are so technical that consumers and families cannot understand them.

Use of report cards by consumers can be enhanced by involving consumers early in the development process so that they can participate in developing a user-friendly product that responds to their needs. Consumers and families should advise on data elements, interpretation, and format of presentation. The Massachusetts Division of Medical Assistance, for example, conducted focus groups to hear the opinions of consumers on different data elements and formats.

Report card developers should attend to cultural issues. Consumer and family representatives recommend that report cards be published in the preferred languages of consumers. They also stress that cultural sensitivity goes beyond language preference to include a more general responsiveness to cultural beliefs and ways in which culture affects utilization of services.

Report cards should address consumers' and families' specific needs. Report cards should be designed to address their questions and to do so in ways that are easily understood. They need to take into account the varying levels of linguistic and quantitative skills in the population.

Purchasers of Care

Performance data from report cards can help those responsible for purchasing health care coverage make informed decisions on behalf of employees, retirees or beneficiaries of government programs. Like consumers, purchasers need data presented in ways that allow accurate and complete understanding of plan performance. Given the large number of covered lives and the associated dollars, public purchasers are in an excellent position to demand particular types of performance measurement data from the marketplace, and therefore can influence development in this area. Once data are produced, public purchasers can influence enrollment in managed care organizations and quality improvement activities by distributing report card data within state and Federal government agencies and to advocates, consumers, and other purchasers of care. Public purchasers can also have a significant impact by promoting responsible use of

this type of information and by leading efforts to explain the strengths and limitations of report card information to ensure credible comparisons.

Providers

In addition to system-level data that elucidates a managed care organization's overall performance, report card data allow individual providers to compare their performance to that of other providers in the organization or to established benchmarks. Recognizing the importance of studying provider-level data, many managed care organizations have begun to distribute reports to individual providers displaying the provider's performance relative to colleagues and other normative data. For example, "Healthy People 2000" has been cited as a benchmark against which to judge a managed care organization's preventive immunization rates. A report card can compare individual performance to a standard applicable to all managed care organizations or to an internally-referenced data point (e.g., the average rate within the upper quartile of performance).

Providers have voiced concern, however, that when managed care organizations evaluate an individual provider's performance, they do so against aggregated data from such a small number of providers that the limited statistical power makes it impossible to draw valid conclusions regarding the individual provider's performance. Others disagree, arguing that such comparisons are an important aspect of continuous quality improvement within an organization.

Managed Behavioral Health Care Organizations

Through report cards, the performance of managed care organizations is publicly compared to that of their competitors. To the extent that report cards influence purchasing decisions, they have enormous financial implications in this competitive arena. Report card data are considered newsworthy by the media whose comments about an organization's performance could significantly help or harm its reputation and market position.

Next Steps in Report Card Development

To make report card data available to the constituencies that most benefit from such information, several next steps should be considered:

Standardize data collection. Standardized data collection can ensure the availability of more complete, accurate and comparable data across managed care organizations. Consensus on a minimum data set for report card data would enhance the value of the information.

Use existing data sets. Arguing that "the perfect is the enemy of the good," most experts endorse maximizing the use of existing data sets. While these may not be perfect,

reporting efforts completed with available data will help move the field forward. Stakeholders should not wait for the ideal data specifications and analytic methods that will produce perfectly comparable data.

Identify users. It is necessary to identify potential report card users and better understand their particular needs for data to ensure that all who need performance data will be able to obtain the right type of information in a usable format.

Establish a forum. An ongoing forum is needed to discuss issues relevant to the production and dissemination of report card data. Such a forum should begin by defining the public interest and move to promoting development of increasingly meaningful performance indicators and report cards for consumers. The forum should include the range of report card users and facilitate their discussion of key issues.

Educate users. Methods need to be developed to educate users on technical issues so that they can understand and use report cards in a meaningful way.

Institute a public health approach. Report card efforts have thus far focused exclusively on use of and quality of services. There is now a need to take a public health approach to mental illness and address the needs of communities and populations. Report cards should expand their gaze beyond acute care and treatment settings to evaluate the quality of prevention and early intervention programs. They should broaden their study of access to care by examining not only the use of services in a community but also the population's knowledge of and attitudes toward mental illness and treatment and its awareness of available services.

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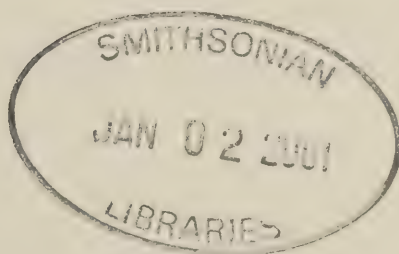
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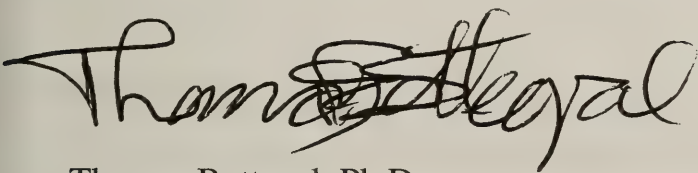
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This is the second of two special centennial issues of the Journal, published as part of our 100th year celebratory activities. These were envisioned as special issues in that the papers in each issue would focus on, or in some way be related to, the centennial theme: *Communications, Past, Present and Future – Within and Among Entities in the Biological Hierarchy of Life*.

The multidisciplinary origin of the *Washington Academy of Sciences* has given the Journal an eclectic image, with a wide variety of subjects and authors appearing over the years. That diversity is reflected in this issue – a paper by Simon *et al.* looks at the emerging technology of Video-on-Demand; and Furman *et al.* explore communication among computer programmers via the programs that they write and modify.

Also, we take much pleasure in recognizing over 100 high school authors who took the challenge to prepare a paper for our essay contest, and especially the six winners who were chosen to be included in this issue.

On behalf of all members of the Academy, I thank each of the authors of this issue for providing us with their view into our centennial theme.

A handwritten signature in black ink, reading "Thomas Bottegal". The signature is stylized with a large, sweeping "T" and a cursive "Bottegal".

Thomas Bottegal, Ph.D.
Editor

Access Policies for Distributed Video-on-Demand Systems

Robert Simon, Padmavathi Mundur and Arun Sood
Department of Computer Science
George Mason University
Fairfax, VA 22030

Abstract

Distributed Video-on-Demand (VoD) systems that deliver digitized video directly to users are expected to become one of the most important types of communication technology enabled by the next generation of computer networks, video servers and distributed multimedia systems. This paper discusses some of the challenges posed to computer science in VoD design and implementation. In a VoD system, tight coordination among all subsystems is required for real-time performance. We argue that a central part of any coordination strategy should be end-to-end *threshold-based* admission control policies. End-to-end admission control policies determine if adequate resources are available along the entire service path of a new video requests so it can be admitted without violating the real-time performance requirements of the requests already in service. Threshold-based policies provide a way of assigning higher priority to selected classes of requests based on their relative importance, such as popularity. This is accomplished by imposing a threshold on other classes, thereby restricting access to system resources for those lower priority classes. This paper presents an analytical model to evaluate such threshold-based admission control strategies for distributed VoD systems with multiple classes of video programs. We prove the existence of computationally efficient ways of determining blocking probabilities for newly arriving requests. Through numerical analysis we show that threshold-based policies offer better performance for selected high-priority video classes.

1. Introduction

The rapid evolution of technology and communication protocols for high speed networks coupled with advances in computer, storage, and display hardware and software has paved the way for new types of distributed multimedia applications. These applications allow users great flexibility in deciding *what kind* of information to obtain or exchange, and *when* to obtain or exchange it. This freedom represents a break from traditional types of mass communication using broadcast medium, such as radio or TV, where the providers and content distributors decide what to send and when to send it. The user-centric aspect of distributed multimedia applications represents an entirely new mode of mass communication.

One of the most important types of emerging multimedia applications are distributed Video-on-Demand (VoD) systems. A distributed VoD system delivers high quality digitized video directly to viewers. A fully realized VoD system is extremely powerful

and flexible because it permits users to decide when, where and what to watch. By untethering viewers from content distributors, VoD offers a prime illustration of some of the creative possibilities offered by distributed multimedia.

Designing and implementing a distributed VoD system poses significant challenges for computer scientists and engineers. This is because, unlike most existing distributed computer communication systems, delivering digitized video to users requires tight coordination of all subsystem components, from files servers and I/O systems, to computer networks, to end-user presentation devices. Such coordination is needed because of the stringent real-time performance and synchronization requirements of video applications and the enormous amount of data present in video objects. A central part of this coordination strategy is the development of an appropriate set of admission control policies. There are two levels of VoD system admission control. The first at the subsystem level, including admission control policies for a video file server. This type of policy may ensure that a request for playing a new video will only be granted if bounds on retrieval latency can be guaranteed without violating the performance requirements of other videos already in service. The second level of admission control policy is end-to-end. End-to-end admission control strategies determine if adequate resources are available throughout the entire path of system resources required by the new request so the request can be admitted without violating the continuous playback requirements of the requests already in service.

This paper discusses the design and analysis of a distributed VoD system in the context of developing end-to-end admission control policies. The successful deployment of a widely available VoD system is to a large extent contingent upon the successful development of end-to-end admission control policies and methods. Our focus is on the development of an analytical framework to evaluate various priority or *threshold* based admission control policies. Using this framework we identify appropriate performance measures, such as system throughput under a variety of demand levels, for evaluating the effectiveness of different policies. The results of our analysis provide the necessary techniques with which to perform capacity planning, match user needs to equipment investment, and guide policy evaluation strategies. We also show the existence of efficient quantitative techniques to compute these performance measures. These performance measures are necessary in order to effectively deploy all large scale distributed systems (Menasce, Virgilio, Almeida, and Dowdy, 1994).

To make this work concrete, we use the design and implementation of a VoD system on the scale of a hypothetical county-wide school system. While the entertainment industry represents a huge market for future VoD services, we believe that VoD systems can have a critical impact on the quality of services provided by many types of organizations, such as educational institutions, business marketing and training, and internal corporate communications. VoD deployed at the level of a school system can be used to distribute lectures, provide teacher training material and show movies or shorter video

clips of educational or cultural value. A major attraction of such a system is its flexibility. Teachers and students select when, where and what kind of videos to watch.

Videos can be viewed by larger audiences in a classroom or lecture room setting via TV sets or video projectors, or individually via desktop and laptop computers. Using the school system as an example, we present numerical analysis which shows the effect of threshold-based admission control on system throughput. Our analysis and numerical results clearly show the need for well designed admission control policies for effectively deploying VoD systems.

The paper proceeds as follows. Section 2 explains how VoD systems could be used by a typical school system. We also describe current and emerging technologies which enable VoD, including issues with respect to video server design and networks, along with compression technology. Section 3 develops an analytical model for our school VoD system. We prove that efficient algorithms exist for calculating these performance measures. In Section 4, we present numerical analysis to show that threshold-based policies result in lower blocking rates for selected classes of requests, as compared to a naive admission control policy. Section 5 offers some observations and a conclusion.

2. Distributed Video-on-Demand Systems

This section describes system architectures, enabling technologies, and issues in designing admission control policies for distributed Video-on-Demand systems. These topics are illustrated in the context of a hypothetical VoD system designed to serve the needs of a county wide public school system. We call a system of this type School Video-on-Demand (S-VoD).

System Architecture

Figure 1 shows the overall S-VoD system architecture. The central repository, or Archival Server (AS), provides high capacity long term video storage. The server is connected via a network to school system sites. This network is used to download videos directly to a high speed video server within each site. The videos are downloaded to a particular site upon a user request from that site. Figure 2 shows the S-VoD distribution system inside a typical school system site. Videos are stored locally on a smaller but faster server, called a Video File Server (VFS). VFSs have network connections to the central AS. A VFS is a high speed file server capable of real-time delivery of multiple streams of digital video. The VFS transmits to video display stations via set-top boxes and PCs, over a Local Area Network. VFSs have lower storage capacities than an AS.

A user requests a particular video via system software. Since PCs and set-top boxes do not have sufficient capacity to store entire video clips, the video is transmitted directly

from the VFS into the display device via the school sites LAN. If the requested video is not present on the VFS it needs to be obtained from the AS. An overview of S-VoD operations follows:

- Video clips are stored in compressed form on VFSs and/or at the archive server.
- An admission control test is performed by the system for each new viewing request. The outcome is either to accept the request and retrieve and display the video, or to reject the request.

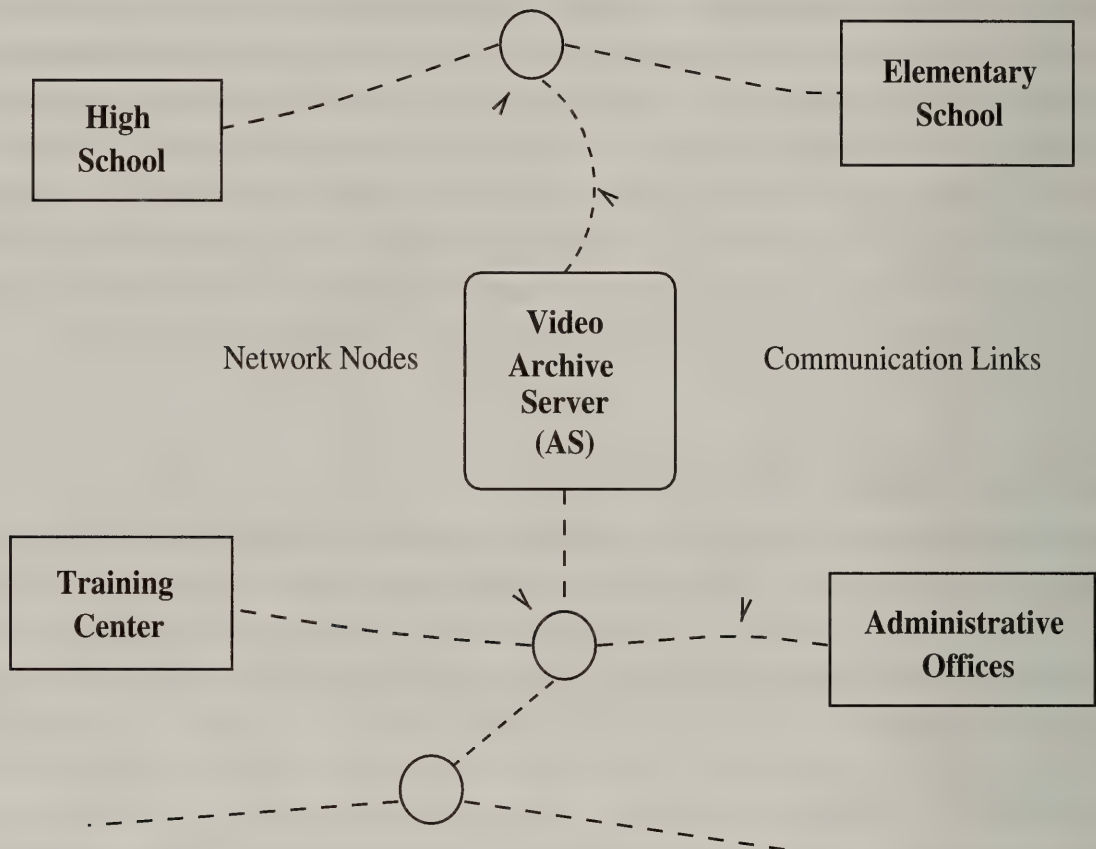


Figure 1: The architecture for a hypothetical Video-on-Demand system for a county wide school district. The system stores videos in a central repository called an Archival Server (AS). Videos are delivered to different locations via a computer communication network.

- If the video is present on the archive server and not on the local VFS, the video is downloaded to the VFS.
- Once the video data is on the VFS it is continuously retrieved from the VFS and transmitted over the network to the set-top boxes or appropriately-equipped PCs.
- The received video data is decompressed at the set-top boxes and displayed at the receiving sites.

In the next section, we discuss the technologies that enable our S-VoD system such as compression, storage and retrieval at the servers, transmission over networks, and decompression at the set-top boxes.

2.2 Enabling Technologies

2.2.1 Compression

Video data is typically stored and transmitted in compressed form. A compression method for color video reduces the amount of space required to digitally represent chrominance and luminance values. This space reduction is usually obtained by several processing steps. Typically, a video frame is divided into square blocks of pixels. This block then undergoes a frequency domain transform step, a quantization step, and a

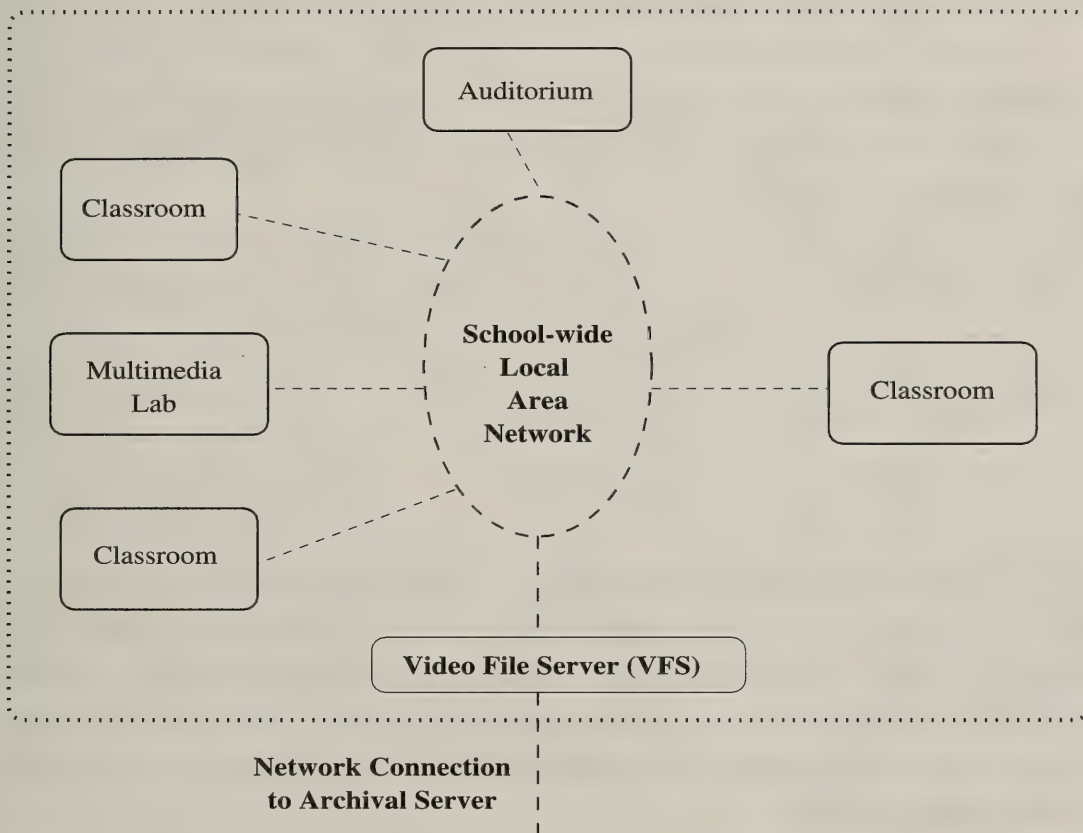


Figure 2: Individual school system sites store local videos for playback on a Video File Server (VFS).

compression step. Further compression is achieved by removing redundant information between frames, e.g., if the background in a scene does not change, there is no need to store the background for each frame. The primary advantage of compression is therefore space savings.

The amount of space savings resulting from compression depends upon the particular technique employed, and can vary from 2 or 3 to 1 to over 100 to 1. Popular compression standards include H.261, for video coding over ISDN lines, different Motion Picture Expert Group (MPEG) standards, such as MPEG-1, MPEG-2 and MPEG-4, and H.263, for very low rate video encoding. Compression standards also vary dramatically

in terms of output quality. For instance, the normal resolution of an MPEG-1 frame is 320 by 240 pixels, while for MPEG-2 the resolution is 720 by 480 (Rao and Hwang, 1996). For our S-VoD system, the compression technique determines the required level of system storage and system throughput. MPEG-1 requires 1.5 Mbps, while data rates for MPEG-2 vary anywhere from 3 Mbps to 100 Mbps.

2.2.2 Video File Servers

Continuous media, such as audio and video, has spatial, temporal and performance constraints not present in textual data retrieval and transfer. Video file servers must offer high storage capacity, low latency retrieval and a high data transfer rate. There are several ways to achieve a cost effective solution to these design problems, including architectural solutions such as faster and larger disks and hierarchical configurations of secondary and tertiary devices that distribute the load within and across different levels (Brubeck and Rowe, 1996).

Server design research has focused on finding efficient storage techniques that minimize the overhead related to the retrieval of multimedia data and maximize the number of concurrent requests. Since disk transfer rates are significantly higher than single stream real-time data rates, it is possible to serve multiple requests simultaneously. This requires disk head scheduling policies which guarantee continuous and synchronized data retrieval. In particular, it is essential that the disk scheduling policy for data retrieval does not starve, even on temporary basis, one video stream in favor of another. A wide range of disk scheduling algorithms are used to achieve this purpose, including Earliest Deadline First, Scan Earliest Deadline First, Grouped Sweeping Scheme (GSS) and Round-robin. These algorithms typically require an admission control test before the video stream goes into service. Once the request is accepted these scheduling algorithms ensure real-time, continuous and starvation-free retrieval (Gemmell, et al, 1995) (Yu, Chen and Kandlur, 1992).

The effect of requiring admission control for video server access is to place a limit on the number of simultaneous requests that can be handled at the VFS. Different types of admission control tests are possible. For instance, deterministic admission control strategies are based on worst case assumptions regarding service times, while statistical admission control strategies typically use a stochastic characterization for service load and performance reliability (Chang and Zakhor, 1994) (Vin, Goyal, Goyal, and Goyal, 1994).

In addition to disk scheduling methods, data placement and retrieval techniques are important, since a multimedia data stream is stored as blocks on a disk. Because of presentation continuity requirements the placement of video data blocks on a disk is critical. This problem is exacerbated by the presence of multiple video streams. Techniques used to solve the block placement problem include *random*, *contiguous*, and *constrained* block placement (Rangan and Vin, 1993) (Vin and Rangan, 1993). Use of these policies involves

different tradeoffs and considerations. For instance, random block allocation is common in storage server architectures, but may not guarantee support for continuous retrieval, because average or worst-case access and latency times of successive block retrieval may be too large. This forces the use of complex buffer management methods in order to nullify the variation in retrieval time. Contiguous block allocation guarantees continuous retrieval, but results in disk fragmentation and wasted space. Constrained block allocation can be used to satisfy the real time playback requirements of multiple video streams through block placement and interleaving strategies. These policies also result in simpler buffer management procedures. The drawback is that constrained block allocation policies require detailed knowledge of characteristics of video data for a particular clip or movie.

Hierarchical storage consisting of secondary and tertiary storage devices are essential for meeting large storage requirements of a VoD system. Secondary storage devices at the VFS may consist of regular hard disks or RAID devices. While it is expensive to maintain all video programs on secondary storage devices, tertiary storage devices available to each archive server, such as magnetic tapes and optical disks, provide a cost effective way of storing terabytes of data for a VoD system. These devices are not suitable for directly servicing concurrent user requests because they typically have low data transfer rates.

2.2.3 Networks

The network in a VoD system needs to simultaneously serve multiple users. The networked transfer of data between archive servers and the video file servers requires the availability of networks with transmission rates on the order of gigabits per second. These rates are obtainable by high speed, *Integrated Services Networks* (ISNs) such as Asynchronous Transfer Mode (ATM) or the next generation of the Internet. ISNs provide reliable and real-time data transfer by reserving and allocating resources for connections on an end-to-end basis. Connection establishment protocols include the Resource Reservation Protocol (RSVP) in the Internet, and Q.2931 for ATM (Zhang, Deering, et al, 1993).

VFSs are connected to end-user display units (described below) by a Local Area Network or other type of distribution service. Examples of these distribution networks include various kinds of Digital Subscriber Line technology using twisted pair wiring for digital transmission, and computer communication networks such as 100 Mbps Ethernet and ATM for a LAN environment.

2.2.4 End-user Display Units

The end-user display unit consists of a high resolution workstation or a high-definition television, an interactive control device, and a network interface. The interactive control

device could be a set-top box (STB) providing decoding functionality at the user's premises. The video servers are connected to the STBs over a network. They may also allow some amount of VCR-like interactive control, such as fast forward and rewind. A typical architecture of an STB consists of a *processing subsystem* with an *operating system* to manage the STB, a *video subsystem* to decompress MPEG-2 type video streams, a *graphics subsystem* for presentation purposes, and an *audio subsystem* to decode audio to synchronize with the video (Furht, Kalra, et al, 1995).

2.3 Threshold-based End-to-End Admission Control

Implementing VoD systems requires the introduction of end-to-end admission control policies. End-to-end admission control strategies determine if adequate resources are available along the path of the new request so it can be admitted without violating the continuous playback requirements of the requests already in service. The path includes both video file servers and communication networks. Threshold-based admission control policies provide a way of introducing priorities among request classes and distinguish between their relative importance. An attractive approach for maintaining certain performance and throughput levels for more popular classes is enforcing a threshold on classes that are not as popular. The threshold relates to the maximum number of unpopular movies which the system will allow to be supported at one time.

2.4 Video Classification

An S-VoD system will only be used if it can meet viewers demands in a flexible manner; be reasonably economical; does not require extensive maintenance; and can accommodate a wide variety of usage patterns. Achieving these goals requires an accurate viewer model. Our admission control analysis models user habits by classifying types of demands for particular videos. One type of classification is *popularity*. In general, VoD systems must support requests for popular videos, i.e., videos repeatedly requested. True VoD systems also must allow access to videos which are relatively unpopular, and are only occasionally requested. Another classification axis is when the video is available for playback. For instance, some videos may be produced and consumed at the same time, similar to broadcast TV. Without loss-of-generality we identify 3 classes of videos which the S-VoD system must support – *archived*, *first-time* and *ad-hoc*. These three user classes enable system builders to design the system to meet anticipated user demand.

Archived videos are videos produced and stored well in advance of their viewing, are popular, and therefore are used in a semi-predictable way. An example is a 45 minute video clip demonstrating orbital mechanics which the school system may have

purchased. A high school physics teacher may decide to show this clip at different times during the semester.

First-time videos are videos stored immediately before their usage. Similar to archive videos, first-time videos are popular and are requested in a semi-predictable way. An example of a first time video may arise during a space shuttle mission. NASA may provide daily status briefings for these missions. Each briefing may last anywhere from 5 to 20 minutes, and can be recorded and distributed digitally to interested school systems via satellite, cable TV or computer network. Individual classes could playback the videos that day during homeroom periods.

Ad-hoc videos are videos whose usage is relatively spontaneous and whose average usage patterns cannot reasonably be predicted in advance. They may or may not be stored (or produced) well in advance of their usage. An example of this kind of clip is a high school English teacher who wants to show an experimental production of a Shakespearian play as an ad-hoc response to a particularly interesting classroom discussion about alternate staging.

3. S-VoD Analytical Model

3.1 Threshold-based Admission Control

An admission control procedure for all arriving requests is run at the VFS. The procedure determines if capacities are available on the VFS and the network to transfer the data to the user display devices. If the program needs to be downloaded from the archive server, the availability of network capacity for that transfer is checked. In addition to the capacity constraints, the VFS assesses further class-based constraints imposed by the admission control policy.

An admission control *policy* determines whether an arriving request for a certain class of videos should be admitted, given the current state of the S-VoD system. Threshold-based policies provide the means for increasing the number of requested videos from preferred classes. For example, in our situation we may need to place access restrictions on ad-hoc requests (class 3), so we can support more of the semi-predictable requests (class 1 and class 2). A threshold *class-3* policy limits the class 3 requests up to a specified threshold, and always accepting class 1 and class 2 requests if there is available capacity.

Without loss of generality, suppose there are three classes of requests and the vector (n_1, n_2, n_3) describes the state of the S-VoD system in terms of the number of class 1 requests, n_1 , class 2 requests, n_2 , and class 3 requests, n_3 . The state of the S-VoD system is describable as a state space constrained by capacity. A capacity constraint is defined by $\sum_{k=1}^3 n_k \leq C$ where C is the maximum number of simultaneous requests that a VFS can handle. The state space can be further constrained by other restrictions, such

as when the admission control policy restricts access to one of the classes by enforcing a threshold on that class. The state space for a threshold class-3 policy is illustrated in Figure 3. The state space is bounded by the three positive co-ordinates and the triangular plane representing the capacity limitation. The threshold plane on the class 3 dimension truncates the state space. All the admissible states are within this bounded space. The state space, Ω , is defined by

$$\Omega \equiv \{(n_1, n_2, n_3) : 0 \leq n_1 \leq C \text{ and } 0 \leq n_2 \leq C \text{ and } 0 \leq n_3 \leq l_3 \text{ and } \sum_{k=1}^3 n_k \leq C\}$$

Given the state space of the system based on the admission control policy, we can identify those states where an arrival is blocked either because of the capacity constraint or the threshold. We compute blocking probability using this information.

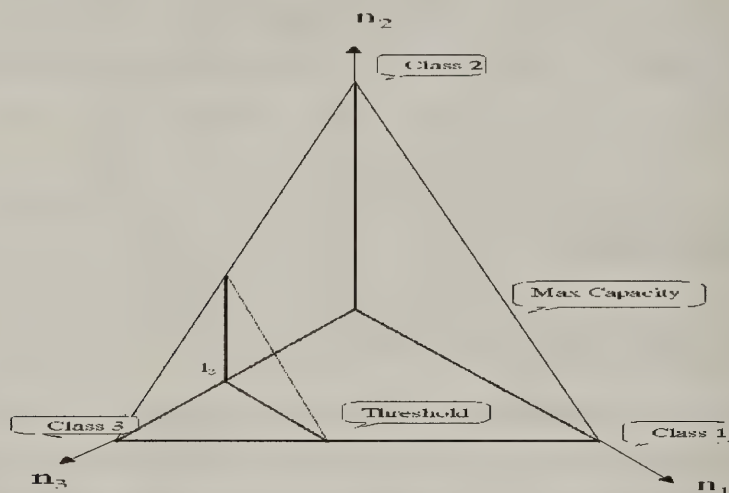


Figure 3: S-VoD State Space

3.2 Three Class Server Model

Each VFS at a school site has access to a centrally located pool of archive servers. The video programs will be served only through the VFS. The programs from the archive servers therefore need to be first downloaded to the VFS. The VFS handles a maximum of C simultaneous requests, primarily determined by the I/O bandwidth of the server. The VFS acts as C virtual servers, each of which is serving a request. We assume that the requests for viewing new videos arrive according to a Poisson distribution and the service times according to a general distribution. The Poisson assumption for arrival rates is the standard assumption used in analysis of VoD queueing systems (Li, Wong, Liao, Qiu, 1996).

The state of the S-VoD system is describable by a Markov chain with a birth-death process and a state space Ω . By using the Markov chain model, the threshold type admission control policy falls into a class of policies known as *coordinate convex* (Aein, 1978). Arrivals or departures are never blocked, except for boundary states, where any further arrivals are blocked. The advantage of coordinate convex policies is that they give rise

to product form solutions to the equilibrium state probabilities, from which performance measures such as blocking probabilities can be determined.

There are three classes of requests: class 1 refers to archival programs, class 2 to first-time programs and class 3 to ad-hoc programs. Based on this model class 1 and class 2 requests are more “important” than class 3, and more of those requests should be admitted into the system. We impose a threshold on class 3 requests because we would like class 1 and class 2 requests to have access to a larger share of the server resources.

We assume adequate network resources between the VFS and the user display devices, as well as to the archive servers. This means that there is no blocking at either the network or the archive server level. The VFS is modeled as a single node, multi-server, 3 class queueing model. The following analytical model evaluates admission control policies based on different threshold values for class 3 at the video server. Blocking probability for each class under a certain class 3 threshold value is computed using the approach below. We first present some model parameters and definitions:

Model Parameters:

λ_1	average arrival rate of request for archival programs (class 1)
λ_2	average arrival rate of request for first-time programs (class 2)
λ_3	average arrival rate of request for ad-hoc programs (class 3)
$1/\mu_1$	average service time for class 1
$1/\mu_2$	average service time for class 2
$1/\mu_3$	average service time for class 3
C	maximum number of requests that the VFS can handle simultaneously
l_k	threshold for class k , $k = 1, 2, 3$

Definitions:

- P_{b_1} - blocking probability for class 1 requests
- P_{b_2} - blocking probability for class 2 requests
- P_{b_3} - blocking probability for class 3 requests
- $P(n_1, n_2, n_3)$ - probability of n_1 class-1 requests and n_2 class-2 requests and n_3 class-3 requests at the VFS, $\sum_{k=1}^3 n_k \leq C$
- Ω - set of admissible states under a given policy for a system with threshold on all classes,
$$\Omega \equiv \{(n_1, n_2, n_3): 0 \leq n_1 \leq l_1 \text{ and } 0 \leq n_2 \leq l_2 \text{ and } 0 \leq n_3 \leq l_3 \text{ and } \sum_{k=1}^3 n_k \leq C\}$$
for a threshold class-3 system,

$$\Omega \equiv \{(n_1, n_2, n_3) : 0 \leq n_1 \leq C \text{ and } 0 \leq n_2 \leq C \text{ and } 0 \leq n_3 \leq l_3 \text{ and } \sum_{k=1}^3 n_k \leq C\}$$

- Ω_1 - set of blocking states for class 1 requests
- Ω_2 - set of blocking states for class 2 requests
- Ω_3 - set of blocking states for class 3 requests

As shown in (Aein, 1978) and (Kaufman, 1981), the equilibrium probability, $P(n_1, n_2, n_3)$, has the following product form:

$$P(n_1, n_2, n_3) = \frac{1}{G} \prod_{k=1}^3 \rho_k^{n_k} / n_k!, \quad \text{all } (n_1, n_2, n_3) \in \Omega \quad (1)$$

where

$$G = \sum_{(n_1, n_2, n_3) \in \Omega} \prod_{k=1}^3 \rho_k^{n_k} / n_k!$$

and

$$\rho_k = \lambda_k / \mu_k$$

The blocking probability, P_{b_k} , is given by

$$P_{b_k} = \sum_{(n_1, n_2, n_3) \in \Omega_k} P(n_1, n_2, n_3) = G(\Omega_k) / G \quad (2)$$

where $\Omega_k = \{(n_1, n_2, n_3) | (n_1, n_2, n_3) \in \Omega, (n_1, n_2, n_3) + \bar{e}_k \notin \Omega\}$ and \bar{e}_k is a vector set to (1, 0, 0), (0, 1, 0) or (0, 0, 1), where the 1 is in the k^{th} position. Ω_1 , Ω_2 , and Ω_3 are the set of blocking states for class 1, class 2, and class 3 requests respectively.

The cardinality of Ω grows on the order of C^k , making exhaustive enumeration techniques computationally too expensive. Hardware limitations rule out computing G for even moderate sized problems. We therefore must develop alternate, computationally efficient methods for computing G . Some previous studies in finding computationally tractable solutions for computing G were done in the context of multi-rate circuit switched networks. For instance, Kaufman (1981) and Roberts (1981) independently developed recursive relations to compute the G factor for complete sharing policies. Threshold type policies introduce additional blocking states that should be included in the computation of blocking probabilities. Also, the state space Ω is now truncated according to the threshold values. Kaufman/Roberts recursion was generalized to compute blocking probability for multi-rate tree networks in (Tsang and Ross, 1990). Here we develop a recursion for a

single node, multi-server, 3 class threshold type system that is similar to the recursion presented in (Tsang and Ross, 1990) (Mundur, Sood, and Simon, 1998). The recursion is applicable to one or more classes having a threshold restriction.

The basic idea behind the recursion is summing recursively along disjoint parallel planes on the diagonal, as shown in Figure 4 for a two-class situation. Since each request requires one server at the VFS, the number of requests present in the system also indicates the number of server resources being used. From the summing technique, we get a distribution in terms of the total number of servers being used. Denote the total number of servers used as $I = \sum_{k=1}^3 n_k$, and define a state space,

$$\Theta(i) = \{(n_1, n_2, n_3) \in \Omega : \sum_{k=1}^3 n_k = i\}$$

The distribution q_i indicates the number of servers being used:

$$q_i = P(I = i) = \sum_{(n_1, n_2, n_3) \in \Theta(i)} P(n_1, n_2, n_3), \quad i = 0, 1, \dots, C \quad (3)$$

Define,

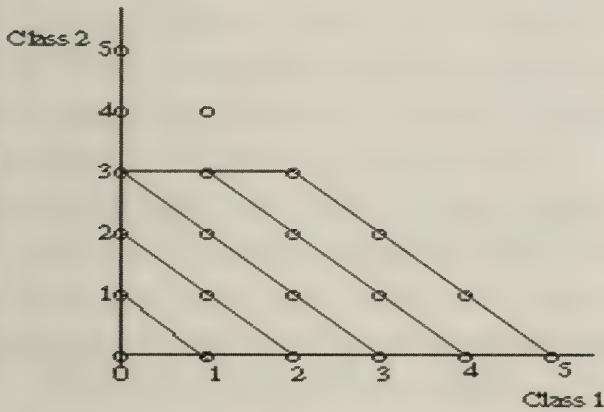


Figure 4: Planar States for Distribution q_i

$$G(i) = \begin{cases} \sum_{(n_1, n_2, n_3) \in \Theta(i)} \prod_{k=1}^3 \rho_k^{n_k} / n_k! & i = 0, 1, \dots, C \\ 0 & \text{otherwise} \end{cases}$$

Multiplying (3) with G and substituting for $P(n_1, n_2, n_3)$ from (1) we get the expression above for $G(i)$,

$$G(i) = q_i G \quad (4)$$

To handle threshold type policies, we define a threshold value which is less than C to limit the number of requests for those classes. Define $l_k < C$ as the threshold for class k requests. Define for $k = 1, 2, 3$,

$$B_k(i) = \begin{cases} P(I = i, n_k = l_k)G & \text{if } l_k \leq i \leq C - 1 \\ 0 & \text{otherwise} \end{cases} \quad (5)$$

$B_k(i)$ is the unnormalized probability of being in one of the additional blocking states due to the threshold. If no threshold is defined for a particular class, $B_k(i)$ for that class is 0. The blocking probability P_{b_k} is given by:

$$P_{b_k} = P(I = C) + P(I \leq C - 1, n_k = l_k)$$

$$P_{b_k} = \frac{G(C) + \sum_{i=l_k}^{C-1} B_k(i)}{\sum_{i=0}^C G(i)} \quad (6)$$

To compute blocking probability, we need only calculate the G factor and $B_k(i)$, $i = l_k, \dots, C - 1$, for $k = 1, 2, 3$. We use the following recursion to accomplish that.

Theorem 1

$$G(i) = \frac{1}{i} \sum_{k=1}^3 \rho_k [G(i-1) - B_k(i-1)], \quad i = 1, \dots, C \quad (7)$$

The proof of Theorem 1 is contained in the Appendix. The result is the computationally efficient form we have been seeking.

Based on our classification of viewer needs, it is reasonable to limit class 3 ad-hoc requests and allow more of predictable class 1 and class 2 requests to be accepted into the system. We therefore must compute $B_k(i)$ for a threshold class-3 system. A threshold class-3 system allows class 3 requests up to a threshold and always accepts class 1 and class 2 requests if capacity is available. By definition $B_1(i) = 0$ and $B_2(i) = 0$. A new function $r(i)$ is used to compute $B_3(i)$ and to determine the resource distribution of class 1 and class 2 requests. This is defined as

$$r(i) = \frac{1}{i} [\rho_1 r(i-1) + \rho_2 r(i-1)], \quad i = 0, \dots, C - 1 - l_3 \text{ and } r(0) = 1$$

$r(i)$ is similar to $G(i)$ and is computed using the same recursion as in Theorem 1, but only on class 1 and class 2 state space. Notice that by definition, $B_3(i)$ indicates a resource usage of l_3 requests for class 3.

$$B_3(i) = (\rho_3^{l_3}/l_3!) r(i - l_3), \quad i = l_3, \dots, C - 1 \quad (8)$$

Stripping off the recursion in (8), we have

$$B_3(i) = (\rho_3^{l_3}/l_3!) [\rho_1^{(i-l_3)}/(i-l_3)! + \rho_2^{(i-l_3)}/(i-l_3)!]$$

which can be proved from equilibrium conditions, the product form expression in (1), and the definition of $B_3(i)$.

4. Numerical Results

This section demonstrates the effect of various threshold-based admission control policies on blocking for each of the classes. We show that using carefully chosen threshold levels for threshold based admission control policies results in higher acceptance rates for selected classes. Specifically, the acceptance rates are higher for selected classes for threshold policies than complete sharing policies, where all classes of requests are admitted into the system as long as capacity is available. An admission control policy defines a threshold for class 3 and admits class 3 requests only up to that threshold. Different threshold values result in different levels of blocking for each class. The acceptable blocking level for each class is decided based on the performance goals of the VoD system. The numerical results test the advantage of having flexible class 3 thresholds and the ability to set thresholds at various levels to achieve the desired performance for all classes.

Our experimental setup studies the effects of changing arrival rates and threshold values. The average service times are set to one. The capacity of our hypothetical school S-VoD system is assumed to be $C = 500$, allowing up to 500 simultaneous requests. This could roughly match the number of network connections a county-wide school system might have. Further, this capacity should be large enough to accommodate requests from various classes and laboratories in the school for video on demand. We assume a dedicated VFS for each school. Within the school environment, we assume that there is enough network bandwidth to all the display stations. We assume no blocking due to the network or the archive server wherever archival transfers are considered.

For our S-VoD system, we assume three classes of requests, class 1 (archival), class 2 (first-time), and class 3 (ad-hoc) to the VoD system. We assume that class 1 and class 2 requests are more important than class 3 requests and should receive higher priority and a larger share of the server resource. For that reason, we impose a threshold

restriction on class 3, restricting the sharing of server resources. One result of this policy is that even if there is server capacity available in the S-VoD system, a class 3 request is blocked by the threshold restriction. Class 1 and class 2 requests are accepted as long as there is capacity available. Since both class 1 and class 2 are limited by the capacity, blocking probability will be the same for both.

We use the results of the previous section to compute blocking probability for each class. The steps involved are:

- The recursion $r(i) = \frac{1}{i}[\rho_1 r(i-1) + \rho_2 r(i-1)]$ is used to first compute all $r(i)$ s.
- Equation (8) is used to compute $B_3(i)$ next.
- Once all $B_3(i)$ are determined, Theorem 1 is used to compute $G(i)$.

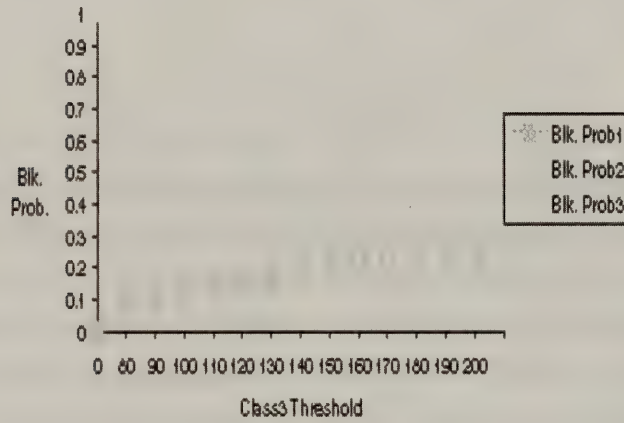


Figure 5: Blocking Probabilities on the y-axis for varying Class 3 Threshold on the x-axis, $\rho_1 = 300$, $\rho_2 = 150$, $\rho_3 = 200$

- Blocking probability for all three classes are calculated as follows:

$$P_{b_1} = \frac{G(C)}{\sum_{i=0}^C G(i)} \quad (9)$$

$$P_{b_2} = \frac{G(C)}{\sum_{i=0}^C G(i)} \quad (10)$$

$$P_{b_3} = \frac{G(C) + \sum_{i=l_3}^{C-1} B_3(i)}{\sum_{i=0}^C G(i)} \quad (11)$$

- The throughput is computed using $\lambda_k (1 - P_{b_k})$.

A computer program was written to compute blocking probabilities using equations (9), (10) and (11). The program used standard 15-digit double precision using GNU C compiler on a Sparc workstation to compute our results. All numerical experiments assume a maximum capacity of 500 simultaneous requests. The main focus of threshold-based

analysis and these experiments is to set a threshold that results in a tolerable level of blocking for class 3 with a desirable level of blocking for class 1 and 2.

The results of the first numerical analysis are shown in Figure 5, demonstrating the effect of varying the admission threshold for class 3 while ρ_1 , ρ_2 , and ρ_3 are held constant. The threshold for class 3 ranges from 80 to 200, ρ_1 is set to 300 and ρ_2 to 150 and ρ_3 to 200. As the threshold for class 2 approaches the value of the blocking probability for class 1 increases as a result of increased sharing of resources. The blocking probability for class 3 decreases because of increased threshold. Eventually the situation becomes similar to complete sharing policy, where each class has the same blocking probability. Notice that the blocking probability for both class 1 and class 2 are the same because they are both limited by the capacity of the VFS. However, the respective throughput for class 1 and class 2 will depend on the arrival rate for each class. The throughput using the same set of experimental parameters is shown in Figure 6.

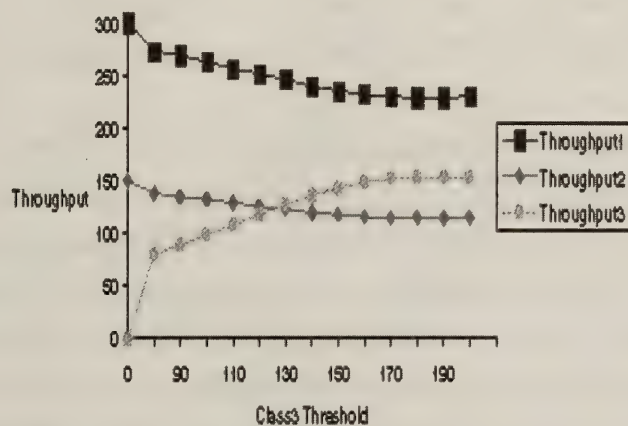


Figure 6: Throughput on the y-axis for varying Class 3 Traffic Intensity on the x-axis, $\rho_1 = 300$, $\rho_2 = 150$, $\rho_3 = 200$

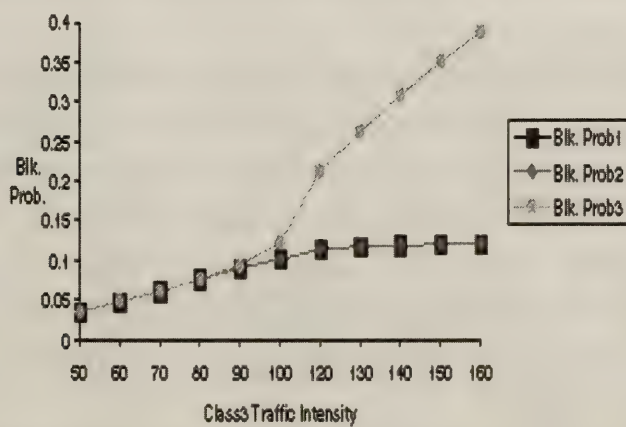


Figure 7: Blocking Probabilities on the y-axis for varying Class 3 Traffic Intensity on the x-axis, $\rho_1 = 300$, $\rho_2 = 150$

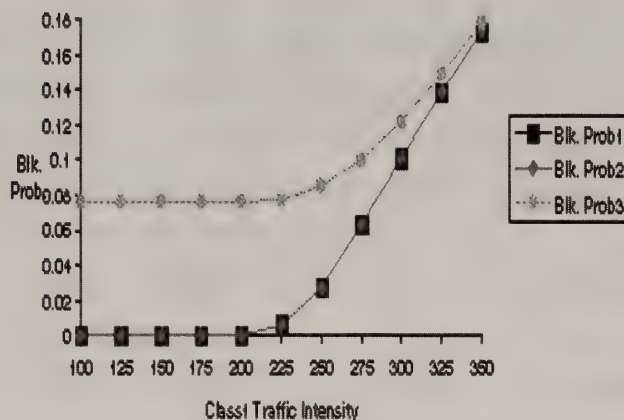


Figure 8: Blocking Probabilities on the y-axis for varying Class 1 Traffic Intensity on the x-axis, $\rho_2 = 150$, $\rho_3 = 100$

Figure 7 shows the effect of increasing the arrival rate of class 3 while maintaining a fixed threshold at 100. The blocking probability sharply increases for class 3 as the arrival rate goes beyond the threshold, while the blocking probability for class 1 and class 2 barely varies.

Figure 8 shows the effect of increasing the arrival rate for class 1, while maintaining a fixed arrival rate for class 2 and 3 and a fixed threshold for class 3 at 100. Blocking for both classes remains constant until the value of ρ_2 approaches capacity, at which point, blocking for both classes increases rapidly, as expected. At higher values of class 1 traffic intensity, all three classes have the same blocking as capacity becomes the overriding limiting factor for all three classes and threshold effects become negligible.

The results shown in Figures 5 – 8 demonstrate the basic relationship between the arrival rates of classes, the threshold of class 3, and the resulting blocking probability. The advantage of being able to change thresholds on class 3 to achieve the desired blocking on class 1 and 2 is illustrated in Figure 9. Lower thresholds on class 3 result in lower blocking probability for class 1 generally and in particular, keep blocking to a low level in the face of increasing class 1 arrival rate.

Figure 10 shows that low thresholds again result in stable blocking for class 1 and class 2 as class 3 arrival rates are increased. There is more variability in class 1 and 2 blocking with respect to increasing class 3 arrival rate at higher thresholds. This result is expected because at higher thresholds, the situation degrades to one of complete sharing.

The effect of varying class 1 and class 3 arrival rate in lock step on class 3 blocking is shown in Figure 11. Low thresholds result in higher blocking for class 3, more so at higher traffic intensities and as mentioned before, results in lower blocking and stable performance for class 1 and class 2.

All of these results demonstrate the advantage of using threshold based end-to-end admission control policies in order to manage system throughput for popular videos.

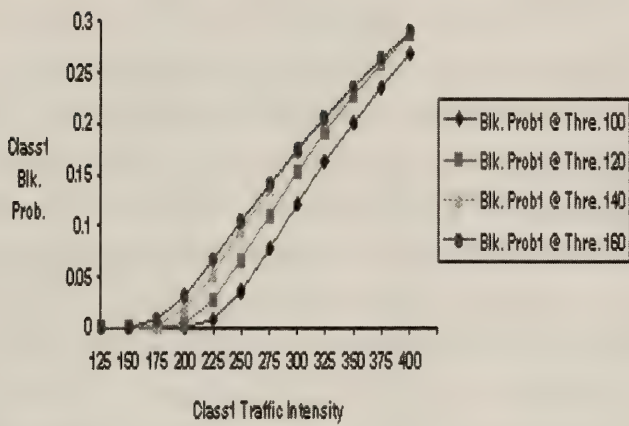


Figure 9: Class 1 Blocking Probability on the y-axis for varying Class 1 Traffic Intensity at different Thresholds on the x-axis, $\rho_2 = 150, \rho_3 = 150$

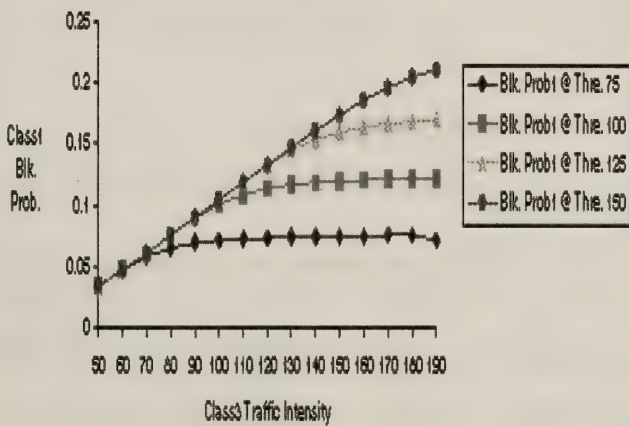


Figure 10: Class 1 Blocking Probability on the y-axis for varying Class 3 Traffic Intensity at different Thresholds on the x-axis, $\rho_1 = 300, \rho_2 = 150$

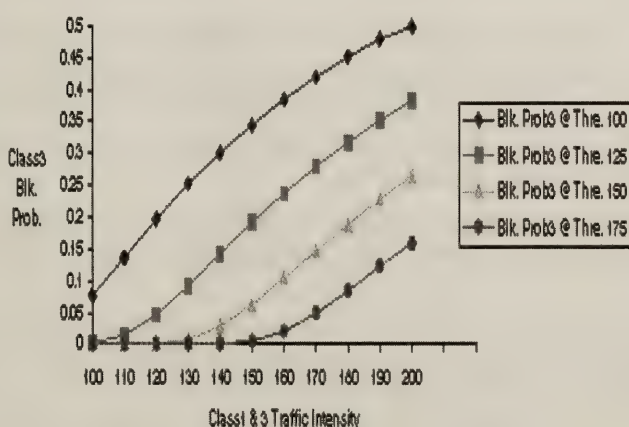


Figure 11: Blocking Probabilities on the y-axis for varying Class 1 and 3 Traffic Intensity at various Thresholds on the x-axis, $\rho_2 = 150$

5. Conclusion

In this paper, we discussed issues related to the deployment of a distributed VoD system. We argued that Video-on-Demand systems represent a new type of user-driven communication technology. We presented a hypothetical Video-on-Demand system for a county-wide school system, called S-VoD. We described enabling technologies required for deploying a S-VoD system. We also provided an analytical model to evaluate the performance of such VoD systems under various admission control policies.

By running a series of numerical experiments we showed that threshold-based analysis results in better performance and lower blocking for class 1 and class 2 requests than if all three classes had the same access to the server resources at the VFS. Our numerical results show that threshold based admission control policies are an appropriate and effective tool for our S-VoD system with multiple classes of requests, each with differing importance. The results of this analysis can be used to guide the deployment of a real Video-on-Demand system on the scale we have described.

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Appendix: Proof of Theorem 1

Let \bar{e}_k be $(1, 0, 0)$ or $(0, 1, 0)$ or $(0, 0, 1)$, where the 1 is in the k^{th} position. Under equilibrium conditions, we have

$$\sum_{(n_1, n_2, n_3) \in \Theta(i)} P((n_1, n_2, n_3) - \bar{e}_k) = P(I = i - 1) - P(I = i - 1, n_k = l_k) \quad (12)$$

Consider resources used $I = \sum_{k=1}^3 n_k$ and multiplying (3) with i and substituting for i and rearranging on the RHS, we have

$$iq_i = \sum_{k=1}^3 \sum_{(n_1, n_2, n_3) \in \Theta(i)} n_k P(n_1, n_2, n_3)$$

Substituting from the balance equation, $n_k P(n_1, n_2, n_3) = \rho_k P((n_1, n_2, n_3) - \bar{e}_k)$ we have,

$$iq_i = \sum_{k=1}^3 \sum_{(n_1, n_2, n_3) \in \Theta(i)} \rho_k P((n_1, n_2, n_3) - \bar{e}_k)$$

$$iq_i = \sum_{k=1}^3 \rho_k \sum_{(n_1, n_2, n_3) \in \Theta(i)} P((n_1, n_2, n_3) - \bar{e}_k)$$

Substituting from (12) for $\sum_{(n_1, n_2, n_3) \in \Theta(i)} P((n_1, n_2, n_3) - \bar{e}_k)$ we have,

$$iq_i = \sum_{k=1}^3 \rho_k [P(I = i - 1) - P(I = i - 1, n_k = l_k)]$$

Multiplying with G and using (4) and moving i to RHS we have the recursion in Theorem 1.

$$G(i) = \frac{1}{i} \sum_{k=1}^3 \rho_k [G(i-1) - B_k(i-1)] \quad i = 1, \dots, C$$

and $G(i) = 1$ for $i = 0$ and 0 for negative i .

QED

A Look at Programmers Communicating through Program Indentation

Susanne Furman, Deborah A. Boehm-Davis, and Robert W. Holt
George Mason University
Fairfax, VA

ABSTRACT

Fundamental to the maintenance of computer programs is software comprehension – the ability to understand what a program does and how it does it. Software comprehension involves reconstructing the logic, structure, and goals of the programmer who originally wrote the program. A number of techniques have been developed to increase the comprehensibility of software by facilitating the implicit communication between the original programmer and succeeding programmers.

One such technique is physically structuring the code to communicate program structure. The most common form of physical structuring is indentation. Although intuition suggests that using a physical structure to highlight a conceptual structure should be helpful, research has not always supported the value of using indentation in communicating program structure.

This research examined earlier work on indentation and identified methodological flaws that may have contributed to the lack of effect of indentation on program comprehensibility. The data from this research suggest that indentation does communicate certain types of information about program structure. Implications of these results for programmers trying to appropriately structure their code for future use are described.

A Look at Programmers Communicating Through Program Indentation

Fundamental to the maintenance of computer programs is software comprehension – the ability to understand what a program does and how it does it. Software comprehension involves reconstructing the logic, structure, and goals of the programmer who originally wrote the program. A number of techniques have been developed to increase the comprehensibility of software by facilitating the implicit communication between the original programmer and succeeding programmers.

One such technique is physically structuring the code to communicate program structure. The most common form of physical structuring is indentation. This approach to facilitating communication is appealing not only intuitively, but also on the basis of theories of program comprehension.

Theories of Program Comprehension

Given that a program is a conceptually connected group of statements translated and executed by a computer, it has been argued that programs are a form of text (Curtis et al., 1986; Detienne, 1996). They argue that principles of text comprehension can apply to the study of software comprehension.

In text comprehension, grammar and composition rules are used to logically organize and coalesce ideas into unified paragraphs or manageable pieces of information. Typographic cues, such as paragraph indentation and white space, signal unified paragraphs. Readers are trained to notice indentation when comprehending a composition. Indentation has been found to aid written communication and to help readers interpret the meaning of a composition. Research has shown that poor indentation slows the reader, introduces ambiguity, and hinders interpretation of written communication (Kessler et al. 1984).

Highlighting information to make program structure more salient should similarly facilitate program comprehension. Specifically, indentation should improve the saliency of broad scope information — information about the overall function of the program or the purpose of each of the modules of the program. Indenting should also aid in identifying detail-level commands.

Other theories of program comprehension support this possibility. Myers (1975) argued that appropriate structuring of the system, its documentation, the project, its management and all communications greatly enhances the maintainability of software and extends the lifetime of large, complex, programming systems.

Brooks (1977) proposed that improved organization of code can reduce the cognitive load involved in understanding a program. His method for achieving this goal constrained programmers to organize programs hierarchically and modularly in such a manner that an operation at any one level can be broken down into a small number of simpler operations. The aim of the process is to reduce the number of units of information that are necessary to understand any given piece of program. He suggested a hierarchical structure for the code, marked by successive levels of indentation, to obtain these reductions.

Soloway and Ehrlich (1984) believe that program knowledge contains plans for specific computations and a particular program language's statement rules. Programmers construct program knowledge from these elements. Larger, more complex chunks indicate higher programmer ability. Using more meaningful chunks and highlighting those chunks through indentation should increase program comprehension.

Boehm-Davis (1988) proposed a cognitive model of comprehension which synthesizes earlier work on cognitive models and information processing. This model consists of a knowledge base, an integration process, and a segmentation-hypothesis generation-verification process, leading to program comprehension. The knowledge base contains a programmer's knowledge of programming and a summary of past programming experiences. The integration stage coordinates the generation and testing of hypotheses based on an interaction between information from the knowledge base and from the current understanding of the program.

The segmentation, hypothesis generation, and verification stage is an iterative loop that predicts solutions from bottom- to top-level commands and forms the basis for this integration process. Segmentation refers to breaking the code into manageable pieces. Although the process is thought to be initially guided by the syntactic structure of the program, it later comes to be driven by schema that develop out of the initial hypotheses, and segments may cut across the physical structure of the program to form plans. Hypothesis generation is the formation of guesses as to what each segment of code does. This step can also guide the re-segmentation of the code.

Verification is the process of examining the code and associated documentation to determine the consistency of the code with the current hypotheses. The current understanding stage represents the programmer's current internal representation of the program. This stage is a holding place for the current set of hypotheses that guide further attempts at integration. The output of this stage is the final understanding of the program. Understanding occurs once sufficient information in the program has been processed to allow a satisfactory interpretation of the program.

This model suggests that anything that helps programmers to segment code into appropriate pieces should improve comprehension. One approach to segmenting code is the use of program design methodologies, that teach programmers to divide programs into smaller units that are easier to code, verify, and modify. Figure 1 shows the Boehm-Davis model.

Research on this issue (e.g, Boehm-Davis and Ross, 1992; Boehm-Davis, Holt and Schultz, 1992) supports the notion that techniques such as structured programming, which aid the segmentation process, do improve or facilitate comprehension and modification performance. Adding physical indications of structure should further aid the segmentation and comprehension processes.

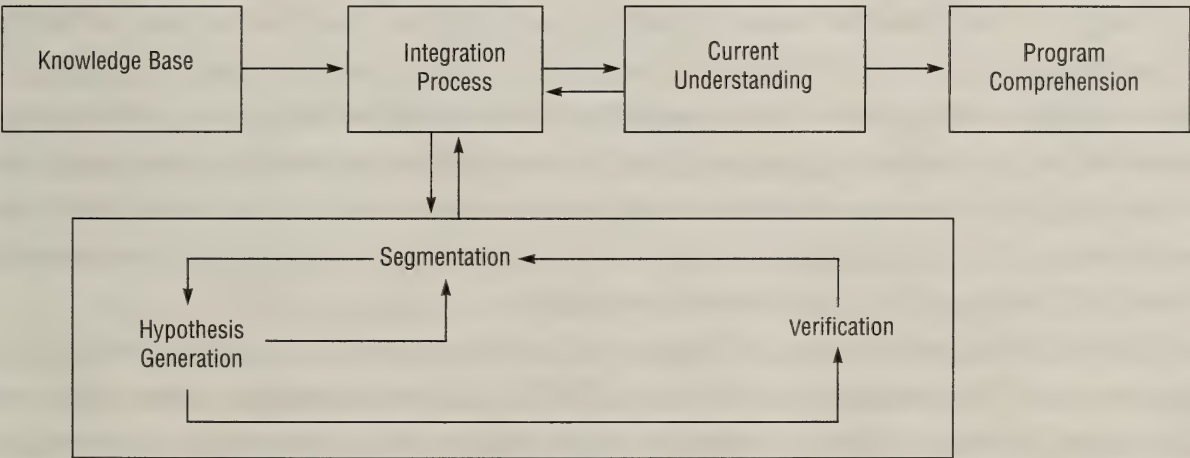


Figure 1. Boehm-Davis model of program comprehension

Research on indentation

Despite the theoretical advantage for using indented code, behavioral research on indentation has demonstrated mixed results (Sheil, 1987). Korson & Vaishnavi (1986), Brooks (1983), Norcio (1982), and Miara et al. (1983) all found that performance was significantly improved when using indented vs. non-indented code. However, Kessler et al (1984) and Shneiderman and Mayer (1979) did not.

However, the studies that did not demonstrate a benefit from indentation each contained some important methodological flaw. For example, Kessler et al (1984) used a 10-question test to measure understanding. However, as Kessler mentions this 10-item test may not have been long enough to ensure reliable results; Kessler does not report the reliability of the test. A second shortcoming is that several researchers chose programs that were short in length (i.e., an average of 54 lines). In general, studies using larger programs (e.g., 1,000 lines of code) were able to demonstrate statistically significant differences (Korson & Vaishnavi, 1986) while those with smaller programs were not.

Finally, Shneiderman and Mayer (1979) attributed their non-significant findings to the fact that one instructor had not emphasized the importance of using modularity in constructing programs. They believe that modular program construction is more difficult to understand without adequate training and they argued that modularization may only increase program comprehension for experienced programmers and more complex programs. This suggests that expertise is another factor that must be considered when examining the effects of indentation.

Research Goal

The goal of this research was to study the usefulness of indentation while correcting the methodological flaws of earlier research, using more and less experienced programmers. Because indentation is often used to indicate program structure, it may provide an outline for understanding the program. Indentation of the program was manipulated by changing the indentation patterns to highlight or obscure the functional structure of the program. The three indentation patterns used were: random indentation, no indentation (i.e., left justified), and normal indentation.

The role of expertise was also examined by studying novice and more experienced programmers. Programmers with more PASCAL programming experience were expected to be better able to identify information using the meaningfully indented form of the program. PASCAL is a structured language in which indentation is commonly used to designate or scoping or blocks of statements.

Random indentation was expected to interfere with this process by obscuring the logical structure of the code and misleading the experienced programmers. Programs

with no indentation were expected to obscure, but not mislead the more experienced programmers; thus, we predicted that this structure would lead to intermediate levels of performance for the more experienced programmers. For the less experienced programmers, we predicted that structure would have little effect.

Method

Participants

Twenty-four inexperienced and 18 experienced Pascal programmers served as participants in this study (10 males and 32 females). The participants were drawn from the population of undergraduate students, graduate students, and faculty members at George Mason University. The majors listed by the participants were: computer science related (30), undecided (5), math (2), biology (1), image processing (1), economics (1), chemical engineering (1), and urban system engineering (1). Assignment to groups was based on the number of significantly sized programs written in the Pascal language, the number of years of programming experience, and the number of Pascal classes completed/taught.

The undergraduates were students in introductory Pascal programming classes and they participated for extra credit provided by the instructors of those classes. Graduate students and faculty were recruited through advertisements posted in the computer science department and on e-mail.

The mean class level of the inexperienced participants was a sophomore with two semesters of programming experience who had completed two computer science classes. These individuals averaged less than 1 year of professional programming experience and had written less than 1 computer program of at least 300 lines in length in any of the languages listed in the background questionnaire. On average, they knew two computer languages and had taken one Pascal class (which was probably the class they were completing at the time of this research). The average age was 25, with a range from 18 to 38. Data collection occurred at the end of the semester, at which time all inexperienced participants had completed course work covering sort programs.

All experienced participants had to have written at least one program 300 lines in length or longer to qualify for the experienced group. The average class level for this group was senior and these individuals had completed an average of 8.5 computer science classes. These programmers ranged in age from 18 to 47 years old, with the mean age being 28. The average number of years of professional programming experience was 2.7, these individuals knew an average of five languages and had completed an average of two Pascal classes. On average, they had 1.4 years of paid professional programming experience and had written approximately 40 Pascal programs at least 300 lines in length.

In addition, these programmers had written programs in Basic (mean number of program written = 5.7), Fortran (mean number of programs written = 7.1), C++ (one individual wrote over 500 programs and another 50; those two scores are eliminated from the mean number of programs written = 2.78), and LISP (mean = 1.1). After completion of the tasks, experienced participants received \$20 for their participation. Actual time on task seemed to reflect intrinsic motivation for task completion rather than either the class credit or the monetary compensation.

Inexperienced students were B & C grade level students.

Materials

Programs. The three sort programs, obtained from Wirth (1973), consisted of approximately 60 lines of Pascal code each. Sort 1 was a Shaker sort, Sort 2 a shell sort, and Sort 3 a recursive sort. Each program was presented in each of the three program forms: left-justification (i.e., no indentation), 2-4 space indentation (i.e., normally indented), and randomized indentation. The 2-4 space indented programs were selected from Wirth (1974). To control for any possible indentation bias, an algorithm was used to randomize the indentation patterns for the randomly-indented sorts. The program used the normally-indented version of the sort as the basis for the indentation patterns. It counted the number of spaces before each line of code in the normally indented version and applied that number of spaces to a randomly selected line in the randomly indented sort.

Background Questionnaire. The background questionnaire asked for information about class in school, number of semesters of programming completed, number of computer science classes taken, number of years of professional programming experience, number of Pascal classes taken, number of programs written with more than 300 lines of code for several languages (Pascal, Basic, Fortran, C++, ADA, LISP, or other), number of programming languages known, age, whether they were currently a paid professional, major, and gender. SAT or GRE scores were requested, however, only a few of the participants completed these items, so those questions were not included in the analyses.

Performance Measures

The objective performance measures for this study included: accuracy (number of correct answers) for three sets of multiple choice questions (8 questions/program); the average look time (i.e., the average time that the programmer spent looking at each line of code); the average search time (i.e., the average time that each programmer took to choose the next line of code to view); and the total number of lines revealed in comprehending the sort program. The subjective measures analyzed included ratings of: how

fatigued the participants were after comprehending each of the forms, how much they liked/disliked each form of indentation, and how difficult they thought each indentation pattern was to comprehend.

Content Questions. Multiple choice questions designed to measure knowledge of program content were developed for each of the three sort programs. These questions consisted of six detailed questions and two global questions for each sort. The reliability of the questions used in this effort was calculated and resulted in a Cronbach's coefficient alpha of 0.77.

Subjective Rating Questionnaire. This questionnaire included a sample and explanation for each form of indentation to refresh the participants' memory. The questionnaire asked participants to provide Likert-scale subjective ratings to questions including: subjective difficulty of performing the task using each form, how much the programmer liked or disliked each form, and level of fatigue after comprehending each form of the sort.

Design

This study used a 3 X 3 X 2 partially confounded mixed Latin Square design. Program form (i.e., indented, non-indented, and randomly indented lines of code) and program version (i.e., Shaker sort, shell sort, and recursive sort) were within subject and level of experience (i.e., language-experienced vs. language-inexperienced) was the between-subjects variable.

Procedure

The DISCOVERY task used in this study was developed by Boehm-Davis and programmed by Holt; the task was inspired by the cloze (Taylor, 1953) procedure. The goal of the DISCOVERY task is to answer questions about the contents and/or execution of the program based on an examination of individual lines of code.

In this task, the entire Pascal program appeared as lines of Xs. The pattern of Xs is created by presenting an "X" in place of any non-blank character (see Figure 1). The task required the participants to select a line of code by depressing the enter key. Once selected, the actual line of code became visible, allowing the participant to view the line of Pascal code hidden under the Xs. The participant could view the line of code as long as the "enter" key was depressed. When the key was released, the line reverted back to the line of Xs.

Program Code
<pre>procedure shuffle (var a:arrangetype; n: integer); var I, j, k: integer; b: boolean; begin for I = 2 to n do begin k: = a [I]; j: = I -1; b: = false; while (j>=1) and (not be) do begin</pre>
As Presented in This Experiment – DISCOVERY Format
<pre>XXXXXXXXXX XXXXXXXX XXXX XXXXXXXXXXXXXXXX XX XXXXXXXXXXXX XXX XX XX XX XXXXXXXXXXXX XX XXXXXXXXXXXX XXXXX XXX X X X XX X XX XXXXX XX X X XXXX XX X X X XX XX X XXXXXX XXXXX XXXXXXXX XXX XXXX XXX XX XXXXX</pre>

Figure 1: Pascal program code and its DISCOVERY format representation.

Each participant received a pre-labeled packet that included an informed consent form, a background questionnaire, a set of questions for each of the three sorts, and the subjective measures. After signing the informed consent form, the participants completed the background questionnaire.

Each participant received instructions including the nature of the DISCOVERY screen, how to choose a line of code at which to look, and how to move around to different

					Subjective Variables		
Form	Accuracy	Search Time ¹	Lines Chosen	Look Time ¹	Difficulty ²	Like/Dislike ³	Fatigue ⁴
Normal	4.93	69.16	74.38	47.53	3.95	2.57	2.62
	(1.85)	(36.49)	(41.20)	(37.20)	(0.83)	(0.67)	(0.49)
Left	4.81	80.84	73.62	47.31	2.69	1.69	2.17
	(2.03)	(47.54)	(37.56)	(34.11)	(1.16)	(0.75)	(0.73)
Random	4.74	71.77	86.41	44.38	2.17	1.36	1.98
	(2.15)	(45.82)	(63.09)	(34.29)	(0.91)	(0.58)	(0.75)

1. Time in seconds

2. Difficulty: 1 = Very Difficult
2 = Difficult
3 = Neutral
4 = Easy
5 = Very Easy
3. Like/Dislike: 1 = Dislike
2 = Neutral
3 = Like

4. Fatigue: 1 = Extremely
2 = Moderate
3 = Not at all

Table 1: Means and Standard Deviations as a Function of Three Forms of Indentation

parts of the program. Participants selected a line of code they wished to look at, typed in the number of that line, and held down the enter key. The line stayed revealed as long as the participant held down the enter key. Once finished looking at that line, the participant released the key and that line reverted to the “Xed” out pattern. The participant continued the process, looking at the selected lines as long as they liked, as many times as they liked, and in any order they chose.

After the programmers felt they understood the sort program, they answered the questions. If any participant was unsure of the purpose of the program, they could re-access the code after they started answering questions to determine its meaning. After they completed the questions for that version of the sort program, they exited out of the program. The primary dependent variables measured were: the average time the programmer took to study each individual line of code (i.e., look time), the average search time taken to select the next line of code to be examined (i.e., search time), the number of revealed lines required to comprehend each sort form, the number of correct answers for the multiple choice questions, the affective response of how much the

programmer liked or disliked the form, subjective difficulty of each form, and the subjective fatigue resulting from each form. Participants repeated this sequence until they completed all three sorts. Finally, a sample of the three indentation forms was presented so that participants could complete the subjective questions about those forms.

Results

Objective Measures

The means for the objective variables of average search time, average look time, and lines chosen as a function of type of indentation were in the expected order (see Table 1). However, large within-group standard deviations made it difficult to confirm a significant difference. To reduce the effect of extreme scores on the variance, these objective variables were transformed to the log (base 10) of each participant's times and number of lines chosen.

Accuracy. Programmers were expected to score higher on accuracy (i.e., answer more multiple choice questions correctly) for the normally indented programs than either the left-justified or randomly indented versions. Results did not confirm the *a priori* predictions. Although the means appear in the expected order, there was no significant difference in performance across the three indentation patterns, ($F(2,72) = 0.32, p > .05$).

However, an analysis of variance did confirm the predicted difference in accuracy as a function of experience, ($F(1,36) = 4.81, p < .05$). The experienced participants answered more questions correctly (mean = 6.06) across sorts and forms of indentation than their inexperienced counterparts (mean = 3.90). An analysis of variance did not confirm a significant form by experience interaction, ($F(2,72) = 0.11, p > .05$) and none of the *a priori* predictions were significant.

Search Time. Search time was the average time that each programmer spent searching for the next line of code to be revealed. Analyses of variance failed to confirm any significant differences in average search times as a function of type of indentation for either the original ($F(1,72) = 0.62, p > .05$) or for the transformed data, ($F(2,72) = 1.15, p > .05$). Experience also played no significant role in performance, ($F(1,36) = 0.47, p > .05$).

Look Time. Look time was the average time spent studying the lines of code revealed. An analysis of variance of the transformed data confirmed a significant difference for average look time as a function of type of indentation, ($F(2,72) = 4.40, p < .05$). Single df comparisons supported *a priori* predictions. Participants also had significantly lower average look times when comprehending programs for the normal (log look time mean = 1.60) vs. random (log look time mean = 1.53) forms of indentation, ($F(1,72) = 11.00, p < .05$). Participants had significantly lower average look time means when comprehending the left justified (log look time mean = 1.60) vs. randomly indented (log look

time mean = 1.53) versions ($F(1,72) = 11.00, p > .05$). Experience did not influence the amount of look time ($F(1,36), 0.06, p > .05$).

Lines Revealed. The number of lines revealed was defined as the total number of lines that each programmer selected while comprehending the program. An analysis of variance confirmed a significant main effect of form of indentation for the log transforms of lines chosen ($F(2,72) = 3.40, p < .05$). Single df comparisons supported the prediction that normal indentation would produce a lower number of lines revealed for the normal (log look time mean = 1.76) vs. randomly indented (log lines chosen mean = 1.85) forms, ($F(2,72) = 6.80, p < .05$). Single df comparisons did not support a priori predictions that normally indented versions would produce lower number of lines revealed than left-justified (log lines chosen mean = 1.82) forms, ($F(1,72) = 3.0, p > .05$). The comparison of number of lines revealed for the left-justified vs. randomly indented forms was not significant, ($F(1,72) = 0.76, p > .05$). Further, the number of lines revealed was not influenced by experience, ($F(1,36) = 0.06, p > .05$).

Subjective Measures

In addition to the objective measures of performance, a number of subjective reactions to the various forms of code were collected. Analyses of variance confirmed significant differences in some of these measures across the two groups of programmers. However, none of the subjective variables differed as a function of experience. Subjective difficulty ($F(1,36) = 0.52, p > 0.5$), like/dislike ($F(1,36) = 0.02, p > .05$), and reported fatigue ($F(1,36) = 0.05, p > .05$) were not significantly affected by experience.

Subjective Difficulty. An analysis of variance confirmed a significant difference in perceived subjective difficulty as a function of indentation form, ($F(2,72) = 12.97, p > .05$). Single df comparisons supported two of the a priori predictions. The randomly indented version (mean = 2.12) was reported to be significantly more difficult to comprehend than the normally indented (mean = 3.95) version, ($F(1,72) = 15.09, p < .05$). The left-justified versions (mean = 2.69) were perceived as significantly more difficult to comprehend than the normally indented version, ($F(1,72) = 7.15, p < .05$). There was no significant difference between the left-justified and randomly indented versions, ($F(1,72) = 0.51, p > .05$).

Subjective Like/Dislike. An analysis of variance confirmed a significant main effect of indentation for the like/dislike measure, ($F(2,72) = 37.98, p < .05$). Normally indented programs (mean = 2.57) were liked significantly more than the left justified (mean = 1.69) programs, ($F(1,72) = 37.5, p < .05$). Similarly, participants liked the normally indented (mean = 2.57) programs significantly more than the randomly indented (mean = 1.36) ones, ($F(1,72) = 19.83, p < .05$). Participants did not rate the left-justified versions significantly differently for like/dislike than the randomly indented versions, ($F(1,72) = 2.79, p > .05$).

Subjective Fatigue. The analysis of variance for fatigue confirmed a significant main effect for indentation form, ($F(2,72) = 4.5, p < .05$). Single df comparisons also supported a priori predictions for fatigue when comparing normally indented vs. left-justified and normally indented vs. randomly indented programs. Participants reported being significantly less fatigued when comprehending the normally indented (mean = 2.62) versions as compared to the randomly indented (mean = 1.98) versions, ($F(1,72) = 4.30, p < .05$). They did not report being significantly less fatigued when comparing comprehension for either the normally indented vs. left-justified versions ($F(1,72) = 2.30, p > .05$) or the randomly indented vs. left-justified (mean = 2.17) versions ($F(1,72) = 0.51, p > .05$).

Summary

The form of indentation did not significantly affect accuracy; however, it did significantly affect the number of lines revealed and the average look times. Overall, normally indented and left-justified versions of the code produced equivalent results. Generally, these two forms of code produced significantly lower average look times and number of lines revealed than the randomly indented versions. The difference between random and either normal or left-indented can be interpreted as due to a facilitation of normal form of indenting or due to an inhibitory effect of misleading indentation.

The subjective measures tend to support the supremacy of normal indentation. The three measures all indicated that normally indented programs were superior to either the randomly indented or left-justified versions. Participants rated the normally indented programs significantly less difficult and less fatiguing to comprehend than the randomly indented versions. In addition, participants liked the normally indented versions significantly more than the two abnormally indented versions.

Experience also played a small role in influencing performance. The experienced participants were significantly more accurate answering the multiple choice questions than the inexperienced participants. However, average search time, lines chosen, average look time, and the subjective variables did not differ as a function of experience.

Effects of a Speed/Accuracy Tradeoff with Levels of Expertise

There was some concern that the task may have frustrated the inexperienced participants such that they may have terminated the program without fully comprehending what the programs did. To test this, correlations were computed for average total time and average accuracy scores for the three sort programs. A significant correlation resulted for average total time and average accuracy score ($r(42) = .431, p < .01$) when computed across both experienced and inexperienced participants. However, the correlation was different when the two groups were examined alone. A large significant correlation between average total time and total scores was found for the inexperienced participants,

$r(24) = .543, p < .01$. However, for the experienced participants, total time and scores were not correlated, $r(18) = .04, p > .05$.

Experienced participants were expected to take less time searching for the next line of code (i.e., average search time), take less time looking at the next lines of code revealed (i.e., average look time), and choose fewer lines of code to look at (i.e., lines revealed) than the inexperienced participants. However, inexperienced participants had lower average look times and chose fewer lines of code to comprehend the programs, but also comprehended significantly less.

Correlations for time and accuracy may have indicated a reason for this reversal of predicted results. Total time was significantly correlated with accuracy for the inexperienced participants, but not for the experienced participants. The shorter times may have resulted in lower accuracy for the inexperienced participants. It appears that inexperienced participants may have been frustrated and may have terminated the task before fully comprehending the programs.

Discussion

Highlighting program structure by indenting code should facilitate software comprehension. Readers have been trained from an early age that in text comprehension, typographic cues, such as indentation and white space, signal unified paragraphs. Programming is in one respect a form of text; therefore, this same logic should hold true in this domain. Appropriate indentation signals the unified logic structure in the program code, thereby aiding in reducing the cognitive load involved in understanding a program.

Despite the theoretical advantage of using indented code, previous research has not been consistently able to demonstrate the superiority of indenting code. Unfortunately, a variety of factors leading to a lack of statistical power have made it difficult to show effects on performance.

For example, in this domain, researchers have typically presented participants with programs that are short (i.e., 20-40 lines of code). Further, comprehension has been measured with one or two of the following measurement tools that may have been unreliable or too insensitive. Variability among programmers for comprehension and debugging times is another problem; this variability has been documented to be as high as a 22:1 ratio (Korson & Vaishnavi, 1986).

To increase the likelihood of demonstrating the superiority of appropriately indented program code this research effort used a new technique (the DISCOVERY technique) and more sensitive measurement tools.

The objective measures included recording the look time, search time, and number of lines chosen. In addition, subjective ratings were collected for fatigue and difficulty

while comprehending the different forms of indentation, and for whether the participants liked/disliked each of the three forms. To help increase the sensitivity of the measurement tools we also used a new technique, which was named the DISCOVERY technique. Previous researchers included only 10 multiple-choice questions to measure comprehension. To increase the sensitivity of measuring comprehension with multiple choice questions, we used 24 questions and these sets of questions were found to be reliable.

Even though the programs used were not as large as some researchers have suggested in previous research (Korson & Vaishnavi, 1986), they were longer than most of the programs used in the past. We were concerned that longer programs may have made it impossible for the inexperienced participants to complete the task.

Finally, we used a within-subject design to reduce the effects of programmer variability. The design did help to reduce the variability to a ratio of 8.5:1, which is lower than the well-documented 22:1 ratio reported in earlier studies. However, these large individual differences still contributed to an inability to demonstrate significant differences for the objective variables without using log transforms.

Although this effort was not perfect, the methodological adjustments did allow us to show that appropriate indentation was significantly superior for some variables and did show a consistent pattern where normal indentation lead to better performance on almost all measures. Specifically, the objective measures showed a superiority for the normally indented and left-justified versions of the code. However, for the more experienced programmers, only the normally-indented code was shown to be superior. Further, the subjective measures clearly identified the normally-indented code as superior from the programmers' point of view.

Overall, indentation offers a sign post for structure. Programmers use indentation to understand where more important lines of code are located and these sections have a certain meaning and function. Indentation aids in signaling this meaning and therefore affects the way in which programmers search for code. This study used relatively short programs, which may only begin to push programmers' short-term memory requirements. Although programmers may be able to compensate for these memory limitations when the programs are short, this is unlikely to be the case for longer programs.

Although future research on indentation is clearly needed, the data from this study, taken together with previous work, suggests that physical structuring of the code is important in communicating information to programmers about the structure of the code. This is particularly important as other forms of communicating to succeeding programmers, such as documentation, are rarely maintained and easily separated from the original code. Thus, taking a cue from our experiences in reading text may be the key to improving communication from programmer to programmer.

Typographic cueing refers to the use of variations in the appearance of text. It has been used since the beginning of printing, for example, for particular emphasis and to

isolate headings. Foster and Coles (1977) were able to demonstrate that forms of cueing which can be readily incorporated into printed text have beneficial effects on the performance of readers, and that the particular style of cueing (capitals or bold print) is an important moderating variable.

The notion of signaling also comes from text comprehension (Meyer, 1975) and refers to the addition of non-content information to a text in order to emphasize certain ideas and/or clarify the organization. The use of both typographic cueing and signaling may also aid in program comprehension.

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Washington Academy of Sciences

Junior Academy of Sciences

High School Essay Contest
in Celebration of the
Washington Academy of Sciences Centennial

Preface for Student Essays

Students in the greater Washington, D.C., metropolitan area high schools, grades 9 through 12, were asked to write a paper of 1,000 words maximum on any topic concerning the theme *Communications Within and Between All Levels of the Biological Hierarchy*. The Washington Academy of Sciences offered the following prizes:

<i>1st Prize</i>	\$1000
<i>2nd Prize</i>	700
<i>3rd Prize</i>	300
<i>Honorable Mention</i>	100

Examples of essay communication topics suggesting the wide range of possible subjects were:

- Any kind of communication between individuals
- Cell to cell
- Organism to environment
- Whales singing in the sea
- Intergalactic or extragalactic communication
- Communication with or between animals such as apes or porpoises
- Color communication: red is anger or emotion; blue is happy or the color of the sky. What do you get when you put red and blue together? This communication needs an interpreter to know what these things mean.
- String-can telephone
- Individual and computer, or individual or non-living.

Over 100 papers were received from twelve schools. The criteria used by the panel of judges to rank the papers were as follows:

- Uniqueness/Originality
- Reflection beyond facts – added value
- Exposition – style
- Accuracy
- Expressed insight into some aspects of communications.

The panel of judges consisted of:

- Mr. Norman Doctor** Fellow, Board of Managers, Washington Academy of Sciences
- Mr. Rex Klopfenstein** Fellow, President-Elect, Washington Academy of Sciences; The Mitre Corporation
- Dr. Cyrus Creveling** Fellow, President, Washington Academy of Sciences; Scientist Emeritus, National Institutes of Health
- Dr. Thomas Bottegal** Fellow, Editor, Journal of the Washington Academy of Sciences; Consultant, Arthur D. Little, Inc.
- Dr. Allen Barwick** Fellow, Vice President, Junior Academy of Sciences; Washington Academy of Sciences; Co-Chair, Essay Contest; High School Physics Teacher; named Teacher of the Century by the National Science Foundation
- Dr. John H. Proctor** Life Fellow, Past President, Washington Academy of Sciences; Centennial Chairman; Co-Chair, Essay Contest

In May 1998, President Cyrus R. Creveling wrote a letter of congratulations to each of the winners with a concurrent announcement on the academy's Website <http://www.inform.umd.edu/WAS/>. The winners were:

- 1st Prize** **Elizabeth Barnwell**, Richard Montgomery High School
The Bridge: Human Communication with Chimpanzees and Gorillas
Teacher: Ms. Beverly Stross
- 2nd Prize** **Lily Simonson**, Richard Montgomery High School
'Equus' The Language of Horses
Teacher: Ms. Beverly Stross
- 3rd Prize** **Anna Burrows**, Wheaton High School
Non-Verbal Communications
Teacher: Mr. J. Dewey Brown

Honorable Mention**Lacey Irby**, McLean High SchoolYou've Got a Friend in Me: The Therapy of Listening Cures
Cases of Suicidal Feelings*Teacher:* Mrs. Demby Banbury**Emily McDonald**, Woodrow Wilson High School

"Dear Ian"

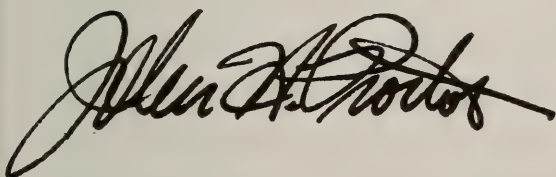
Teacher: Mr. Jay Fellows**Daniel Smolyar**, Wheaton High School

Communicating with Extraterrestrials

Teacher: Mr. J. Dewey Brown

These winners received their prizes during a Washington Academy reception at the National Press Club, Washington, D.C., on November 9, 1998. Winners of the 1st, 2nd and 3rd prizes also read their essays. We wish to thank all those authors who responded to our invitation to prepare an essay.

The Fellows, Members and Officers of the Washington Academy of Sciences are pleased to present these essays in this Centennial Issue of our Journal.



John H. Proctor, Ph.D.

Centennial Celebration Chairman



The Bridge:

Human Communication with Chimpanzees and Gorillas

**Elizabeth Barnwell
Richard Montgomery High School
Rockville, Maryland**

With a tremendous thirst for knowledge and understanding, humans have embarked on many voyages into the unknown, crossing seemingly indestructible barriers, and finding new truths about ourselves. One such voyage is the development in interspecies communication between humans and other species in the biological hierarchy.

Four initial attempts at developing interspecies communication focused on interspecies communication between chimpanzees and humans. One of the barriers in the development of interspecies communication is that animals have been considered inferior to human beings. People were skeptical as to whether or not other species had the capability to communicate in complex languages. Chimpanzees were chosen as the preferred species because they are similar to primitive humans. First, there are physical similarities, such as a larger upper torso than lower limbs, and long fingers with a shorter thumb. More importantly, however, is that chimpanzees, like humans, use tools. For chimpanzees, crumpled leaves act as sponges, and stems are used to get termites out of termite mounds. In addition, chimpanzees are like humans in that they teach their young to use these tools as well as other necessary lessons. Because chimpanzees resemble primitive humans, scientists believe they would be the most capable in learning to communicate with humans.

Regardless of how similar chimpanzees are to humans, success was not immediate in trying to have a two-way communication with chimpanzees. The first attempt at communication with chimpanzees was done by Keith and Catherine Hayes. The Hayes's attempted to teach their chimpanzee, Viki, to speak English. Unfortunately, Viki never could say more than five or six words. In addition, the words she did say, she had great difficulty saying. The fear that chimpanzees really were extremely mentally inferior seemed very real. Fortunately for the future of interspecies communication, there were two scientists who identified the problem as something other than mental inferiority.

After the Hayes's failure, R. Allen and Beatrice Gardner decided to try their theory. These two scientists had read the result of the Hayes's attempt and decided that Viki's difficulty with speaking the words seemed to be more of a physical problem than a lack of intelligence. To test this hypothesis, the Gardners taught their chimpanzee American Sign Language. This language would only require the use of the chimpanzee's already

nimble fingers, hands and arms, but still be an intricate language that, if mastered, would show that chimpanzees have a strong level of intelligence. Washoe, the Gardners' chimpanzee, learned 34 signs in 22 months and 132 signs in 4 years of studying American Sign Language. Since this amount of signing is similar to a human child in the first stages of learning, this new technique was considered a complete success.

Also successful were the third and fourth attempts at two-way communication with chimpanzees. Requiring only the use of the chimpanzee's hands and brain, Ann and David Premack taught their chimpanzee, Sarah, to use plastic symbols in order to speak and be spoken to. Duane Rumbaugh taught his chimpanzee, Lana, to communicate by using a computer. Lana was required to type out sentences that not only had to be complete thoughts, but also had to be grammatically correct. All of the scientists who worked with chimpanzees in order to establish interspecies communication inspired Dr. Francine Patterson to try to establish interspecies communication with a new species, gorillas.

Dr. Patterson began teaching American Sign Language to Koko, a female lowland gorilla, at age one. Although many people had been skeptical of whether gorillas were as intelligent as chimpanzees, over the years Koko, and later a younger lowland gorilla named Michael, proved that gorillas were at least as smart as chimpanzees. After only 36 months, Koko was using 184 signs; by age four and a half she was using 222 signs; and by age six and a half, she was using 645 signs. Koko's score on the Stanford-Binet Intelligence Scale at four years old was 95, only slightly lower than the average for a human child. At 27, Koko has a working vocabulary of over 500 signs, has signed at least 400 more, and can understand about 2,000 words spoken in English.

Perhaps more important than the number of signs she knows, however, is that Koko shows that gorillas have the ability to process and use language. Koko often initiates conversations, describes her feelings and tells why she feels a certain way, and combines signs to give more meaning to a particular sign. In addition, Koko not only taught Michael many signs when they were young, but also made up signs that only Michael and Koko used with each other. It is these points that are the true successes, as these allow for the greater understanding of gorillas. Examples of her creativity such as these reveal the depth of gorillas. Koko's responses and ideas give humans insight into her perspective of the world.

In conclusion, there are two main reasons why interspecies communication is an important goal to pursue. First, by being able to hear what the animal feels, humans can better understand the needs of the species. Understanding the needs of the species allows for the proper protection of that species. Second, the more that is learned about the many species of the world, the more humans learn about themselves and their place in the world. As in this case, humans look outward as our curiosity compelled us to try to communicate with a species other than our own. The resulting communication led to the realization that humans are not the only beings that can communicate through complex languages. In looking to the future, this realization leads to the ideas that although humans

have technology that allows us to communicate with other humans in faster and fancier ways, humans are not considerably advanced in our communication ability. Communication between all levels of the biological hierarchy is still a frontier waiting to be explored. Humans have discovered their ability to communicate with gorillas and chimpanzees: the question is, to which part of the biological hierarchy will humans venture next?

‘Equus’ The Language of Horses

**Lily Simonson
Richard Montgomery High School
Rockville, Maryland**

Horses have an extremely complex but clear system of communication. Although horses are often very vocal, using snorts or other noises to express themselves, the primary communication lies in body language. Horses position their bodies, move parts of their bodies, and use their faces to convey specific messages or emotions. When these motions are learned by humans, they can be applied to training or developing relationships with horses.

Conventional methods for a human training a horse have almost always involved violence and physical harm to accomplish “breaking” the animal. However, the wild mare has discovered a far superior way to train young horses. If a colt has been bothering or attacking other foals or mares, he will be punished by being isolated from the herd. This punishment is signaled by the matriarch of the herd squaring her body up to the young horse, with her eyes on his, her spine completely rigid, and her head pointed straight at the colt. The unruly colt immediately knows that he is to be punished and moves away from the herd. He may come no closer to the group than roughly three hundred feet until the matriarch again signals with her body that he may return. If his punishment is not complete, the mare turns to face him again, telling him not to return.

The possibility of its punishment ending is signaled by the mare turning her body sideways to the colt. However, she only performs this action in response to what the youngster communicates to her. It must show remorse and ask for forgiveness by more body language. This “apology” may be signaled by the foal putting its head and neck down symbolizing submission. Also, a foal will often curl its lips, exposing the teeth, and begins to open and shut its jaws. This action is dubbed snapping and says, “I am only a little foal, please do not hurt me, you are my leader.” This action is also performed toward a strange, larger horse that comes near the foal.

Body language does not always serve the purpose of discipline, but may simply convey the horse’s mood or emotions. As a horse becomes more excited and aroused, its posture becomes more elevated and the entire body seems to get taller. The horse holds its head high, its neck rigid, and its tail up. When it becomes less excited, however, the horse’s head and tail slump and its body droops, making it seem smaller. These signals of stimulation and eagerness or drowsiness, boredom, and submission are clearly understood by

other horses, which react accordingly. The main body signals are called the body check, the rump presentation, and the shoulder barge.

A dominant horse who wishes to thwart the movement of a rival often employs the body check. The horse will swing its body around directly in front of its rival, physically blocking the advancement of the second horse. The second horse must then react by challenging the intimidator, or retreating and signaling submission and recognizing the other as superior. The rump presentation is a defensive response to the body check. The horse being checked swings its body, offering its rear to the original intimidator. This is essentially the threat of a kick, known as an "intention movement." The other horse reads this preparatory stage of action and may or may not respond by continuing the fight. The shoulder barge is a more aggressive form of the body check that involves actual physical contact. The threatening horse actually pushes into the other, and if the other horse is not intimidated, the encounter may escalate to a real fight.

In addition to using their entire bodies, horses may use specific parts of their bodies to express certain attitudes or emotions. A horse's tail signals the animal's level of excitement. If a horse holds its tail high and pushes it out from its body, it signifies exuberance, excitement, activity, and alertness. A young horse may show another its desire and readiness for play by flicking its tail up very high, even so that it curls over its back, towards its head. This is immediately perceived by the other horse as an invitation, and they begin to play. Horses also raise their tails up during sexual encounters due to excitement. The mare often raises her tail up and to the side as an invitation for sexual intercourse. When a horse droops its tail low, keeping it very close to its rear and hind legs, he is indicating fatigue, sleeplessness, submission, physical pain, or extreme fear. A horse shows irritation, confusion, anxiousness, or frustration by flicking its tail sideways, then vertically, and finally in an arc. If a horse becomes extremely angry, the power of the tail movements increases. This extreme force usually signals the onslaught of a violent kick, intended to harm.

Horses also use their legs to indicate changing moods. Pawing the ground is an action in which the horse pounds its leg down, scrapes its hoof backward on the ground, then lifts it up again and repeats the action. It often is used by frustrated horses to show their strong urge to move forward, but is in some way hampered from doing so. A horse may threaten another by striking outward with their front leg in what is known as a front leg lift. If a horse executes a back leg lift, it is defensively signaling that it plans to kick a horse that may be provoking it.

Horses also use their face to convey many more moods and emotions. Horses that are threatening to bite hold their jaws tensely open with their teeth fully exposed. This stiff mouth, which also accompanies anxiety, fear, and pain, contrasts with the sagging lower lip of a relaxed, peaceful, or sleepy horse.

These facial expressions, body movements, leg lifts, and tail movements are all part of the complex body language of horses. All of these signals are universally understood by horses.

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Nonverbal Communications

Anna Burrows
Wheaton High School
Wheaton, Maryland

Human beings can communicate through a variety of ways. The most common way is verbal communication. However, many of us don't realize how often we use nonverbal communication to express our emotions to others. Only now are we beginning to discover and understand how frequently we use nonverbal communication and what a powerful method it is.

The first area of nonverbal communication involves facial expressions. Due to the fact that there are so many muscles in our face, our face can be the most expressive part of our body. Most of the expressions we use are instinctive. The naturally occurring expression of infants is practically identical to those of adults. Babies smile when they are happy, frown when they are sad, and have wide eyes and a gaping mouth when they are surprised. Scientists thought that people might have the same basic expressions because we all are affected by the same influences, such as television. To test this idea, scientists went to the remote island of New Guinea. They filmed the people showing their own facial expressions. They found that their expressions were easily recognizable by Americans.

Each part of the face is useful to convey many different messages. The eyes and eyebrows can be very useful. By staring, one sends the message that they are aggressive. By giving only a little eye contact, the person seems as though they have something to hide. By lifting one eyebrow, one expresses disbelief. With winking an eye, one expresses intimacy. Also, using other parts of the body we can communicate. By leaning towards a speaker, we show interest. By leaning away, we show disinterest. We also communicate with our posture. If we are slumped over, we seem to be in low spirits. However, if we stand erect we seem energetic and confident. We may cross our arms to isolate ourselves from others, but if they are uncrossed we seem to be interested in the conversation. Also, the legs can be used to communicate. A couple sitting next to each other usually crosses their legs towards each other, as a way to exclude any third person from the conversation.

Hand gestures are also an obvious way to communicate. The meaning of the gesture is never mistaken. Almost unconsciously, we rub our nose for puzzlement, tap our fingers for impatience and slap our forehead for forgetfulness. We also give a "thumbs up" for satisfaction or agreement, shake our heads sideways for no and up and down for yes, as well as waving in greeting or farewell. Also, rapidly nodding shows impatience, while

slowly nodding expresses interest and validates what the speaker is saying. These gestures may vary from country to country, meaning one thing in one place and something totally opposite in another. The “thumbs up” sign, a sign of approval in American, may mean something crude in another country.

Another area of nonverbal communication is called proxemics. This is a relatively new concept having to do with the space between people, how they handle it, and what it says about them. One can tell by the distance between two conversing people, what their relationship is. There are four distance zones: intimate, personal, social and public. The first, intimate, is from one to eighteen inches. This area is reserved for an intimate man and woman, family members, or very close friends. Men and women who are not intimate, if put in this zone, will become embarrassed. The awkwardness is even greater when it is a man and a man.

The second area, personal, is defined as one and a half to four feet. This area is designated for most friendly interactions. This is the distance that people who are meeting on the street usually stop at to talk. At social evenings, most people converse somewhere within this distance, usually close to two feet. The third zone, the social zone, is from four to twelve feet. The closer part of this zone is where most business takes place. A boss addressing his worker will stand over the person at this distance as well as when someone meets a new co-worker. The farther part of this area is for formal interactions. The people can sit at this distance and be close enough to talk, but far enough away to work quietly without being rude. Two family members may sit at this distance across the living room in the evenings. They are close enough to talk if necessary, but far enough away to do an individual activity.

The farthest distance of interaction is from twelve to over twenty-five feet. This is the distance from which politicians and speakers address their audience and actors perform. Actors know that it is easier to deceive an audience with stunts far away than at an intimate distance. This space is also used for informal meetings and classrooms. A person of authority can easily address a crowd at this distance. Interestingly enough, many animals will move away once a human enters this distance for their own security.

In some countries, however, people treat space a little differently. In Japan, being crowded together is a sign of intimacy and friendship. In Middle Eastern countries, people also require far less person space than Americans. It is not uncommon to see two men holding hands, but in our country that is unheard of. In Arab countries, men like to look deep into the eyes of the person they are talking with. If in a crowded situation, they are not bothered by personal contact with strangers. In our country, such looks are considered offensive. Americans, if put into a crowded situation, hold themselves rigidly, avoiding any contact with their neighbor. If such contact occurs, they immediately pull away and apologize. While to Americans personal space is essential, people in other countries feel differently.

The area of nonverbal communication is fairly new and there is plenty more to be discovered. With our growing knowledge of nonverbal communication, we may soon be able to interpret it and use it to our advantage. It can help us communicate more effectively with those around us. The old saying may still have some truth: "actions speak louder than words."

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You've Got A Friend In Me: The Therapy of Listening Cures Cases of Suicidal Feelings

**Lacey Irby
McLean High School
McLean, Virginia**

Imagine a room, dark and empty, except for the light of one candle. Lurking in the shadows of this room is a girl. A chain reaction of problems has set off her emotions leaving her weeping tears so silent, no one can hear. She does not want to be a prisoner in hell's realm, but she feels trapped and she thinks there is only one way to escape the closing walls. Taking a staggered breath, the girl pulls a gun out of her jacket pocket. The sound of the bullet chamber being clicked closed echoes around the empty room. The girl places the gun to her head, for she is ready to end all the pain and misery in her so-called life. She cannot pull the trigger. She blanks out for a second, then mindlessly picks up the phone lying next to her and dials a number. Someone answers.

"Hello?"

"Uhh," Kristin, the girl breaks down completely, *"You've gotta help me. I've got a gun to my head..."*

"Put it down," the girl on the other line interrupts. *"Put the gun down."*

You can hear the loud crash of the gun as it is dropped to the concrete floor of the room. The candle flame flutters, and almost goes out. The girl pours out her heart to the teenager on the other end of the phone. She tells her how she hates being ignored and being thought of as a freak. She explains why she sits in her dark room all day and all night writing poetry. She says her life is useless because no one has a heart big enough to care about her ideas. All during this time, the girl on the other end of the telephone line just listens, and slowly begins to see a magnificently terrifying picture being painted before her by this girl she thought she knew.

What is suicide? Why do more than one million young Americans attempt suicide every year? How can these drastic actions be prevented? Questions like these plague everyone's thoughts. The truth is that suicide is a frustrating thing that everyone should have some knowledge about in order to prevent it. First and foremost, suicide is the act of killing oneself intentionally. Suicide is a cry for help – a way to escape life's daily pressures. There are quite a few forms of committing suicide, including doing drugs or alcohol, hanging, inhaling or ingesting a toxic substance, stabbing with a knife, and (as in the scenario) using a gun. In fact, sixty percent of the time people shoot themselves to end their lives.

There are many causes for teenage suicide. Adolescence itself carries enough stress, confusion, and other mixed feelings to make anyone feel as though their world is a mess. Mixed feelings certainly do not decrease if a teen has witnessed a divorce or death in their family. Discombobulated homes and break-ups between boyfriends and girlfriends are other causes. Depression and hopelessness are by-products of these reasons for suicide.

Many people who commit suicide do so on impulse, but one out of five people leave a note. Suicide notes usually are clues to the fact that the writer had some major problems that he or she could not handle. The writer felt alone and no one could ever understand. It is also common for the writer of the note to ask for forgiveness and ask for others to pray for him or her. Many ask God for forgiveness, too, and hope that He will understand. Notes are commonly composed of disorganized thoughts.

The communication between victims of suicidal behavior and thoughts and those very special, underestimated people in life that we refer to as "friends" is actually quite a simple theory. People turn to each other because of a bond known as friendship, which is linked to a concept known as trust. Seventy-five percent of teenagers in the United States tell their closest friend(s) that they want to die before attempting to commit suicide. If ever in that position, keep in mind that this suicidal persona turned to you because they trust you. Remember to be a friend in this time of need. The best possible thing you can do for this person is to listen, not preach, lecture or give advice. Make sure to ask questions to clarify what is being said. Do not take it upon yourself to cure your friend of their suicidal feelings; you are not a professional, but you can help by contacting a trustworthy adult. Most of all, let your friend know that people do care and he or she is not alone.

Even psychotherapists and counselors learn the importance of listening. After making special notes of what a parent has said, a psychotherapist evaluates the patient's self-destructiveness. They analyze the situation and decide if the patient needs to be immediately hospitalized or should be put on an antidepressant drug. Without lecturing, psychotherapists try to change their patients' outlook on life and try to help them realize that suicide is not the answer to their problems and suicide is not the right way to deal with problems. Running from fears does not make them go away; you must confront them. The more people know about how to deal with the pressure and stress of life, the less suicide attempts there will be. Adolescents need to realize that no one can perfectly understand their feelings. We should not keep attempting to explain ourselves, but rather just be open and honest. A true friend will understand and discover the real you if you be yourself.

Go back to the scenario you were imagining before; the girl who tried to commit suicide finally realized people do care, and she found someone to keep her candle burning. The other girl learned that listening is the best therapy and, in doing so, she gained a best friend.

"Kristin?"

"Yeah?"

"Thanks. Thanks for everything."

"Hey! Hello? Welcome to the fact that you have friends!"

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“Dear Ian”

**Emily McDonald
Woodrow Wilson High School
Washington, D.C**

Dear Ian,

What can I say. . . I wish we could have had more time. I wish you could have seen me graduate. I wish you could have seen me get married. I wish you could have seen me have babies. Well maybe you will, just in a different way. I wish everyone in the world could have had the pleasure of experiencing your presence.

You were a special person. It's a shame we couldn't really get to know each other more directly, and not through updates from Mom and Dad. I'm so sorry you were turned away from our house when Dad and Sue were separating. I'm so sorry for all the episodes you had to endure. I hope you know how painful it was for me to see you in that straight jacket on your birthday. And how emotionally scarring it was for me to see you in the handcuffs crying when they took you in for beating up Mom. And when we would take you out and have to drop you off at the homeless shelter. You weren't homeless! You had a home! If I could have done anything about it, I would have kicked that bitch Sue out myself to make room for you!

You used to scare me. When you started using drugs, I was too young to fully understand what was going on. All I knew was that you were withdrawn from the family and you were changing. I didn't really like you being at Mom's because you kind of gave the impression of a time bomb ready to explode at any given moment. I used to watch you sitting at the dining room table shaking from your medication and not being able to utter a word. I feel so much resentment towards whoever was supposedly treating you because they were giving you all the wrong shit! It seemed like you got worse when you took the prescription drugs. Because of ignorance, I figured that the treatment you were receiving would maybe have a positive impact as time went on, but this proved not to be the case.

I apologize for the way I treated you. I guess I acted so distant from you because that was the way you were with me. When we used to go visit you in Baltimore, Mom would always try to get us to hug or at least talk, but neither one of us wanted to go first. I knew that you had a hard time showing your affection so I didn't want to force it on you like Mom did. Now that you're gone, I miss so many things that I just couldn't stand when you were here. For instance, your room was always so junky and smelly at Mom's

but now I don't know what I wouldn't give to have it back that way. I miss your leaving the toilet seat up, I miss you making fun of Beverly Hills 90210. I miss you laughing along with Beavis and Butthead. I even miss you occupying my T.V. for your stupid baseball games. If I had known your time was going to be so limited, I would have done things so differently.

I guess I can't focus on what I should have done, because that's in the past. I think your absence makes me value my other relationships more. I wish I could say that your absence has brought Jessy and I closer together, but I can't. Jessy really has a mental problem that I just can't overlook and try to work around. She has to try to figure herself out before she gets closer to anyone else. Your absence has affected her a lot as well, I'm sure. She hasn't really said anything – I guess that's a similarity that you two possess that I don't. I'm the only one among us that really is able to express myself without hurting myself in any form.

Although it's hard to look at your death in a positive light because you made the decision to have things that way, I really try to look at this positively. Maybe you just weren't meant to live a normal life. Maybe if you would have lived your life past the time that you wanted, it would have been even more painful than it was before. And wherever you are, I'm sure you're at peace. I'm glad you don't have to deal with that tug-of-war inside yourself and with drugs and the people who contributed to your unhappiness that weighed you down every day of your last years. I can't be selfish and try to make myself happy by suddenly making you reappear, when you are happier where you are. I hope that when we have family gatherings and when one of us is having an important moment, that you are able to share it with us.

Your funeral was beautiful. I couldn't have imagined it better. There were people who didn't even have a seat because the room was so packed. I would have talked, but when Dad started talking about when he used to pitch to you when you were little, I broke down and I knew I wouldn't be able to go up there in front of all those people. Everyone seemed to feel guilt more than anything. I could especially see it in your old high school buddies. They felt bad about alienating you when you started to go downhill and not returning your calls when you were steadily making improvement. For that one day Jessy actually went to Mom's and mingled with the people. That is, she actually spoke to Mom and Lora. Dad is having a hard time. So is Mom, but Dad has a harder time dealing with his feelings, while Mom deals with feelings that aren't there all the time. She refuses to drive under your bridge. She thinks that I don't face my feelings about you, but I do. I just prefer to not express them in her presence because you know how she gets. Coach Burkhead has dedicated a birdhouse to you which sits on top of the hill looking over the baseball field. He says he talks to you almost every day. Sometimes it saddens me when I see all the St. Albans boys growing up so sheltered and I can't help but fear one of them may end up the way you did. I'm not blaming you for it, it's just the way things turned out I guess.

I want to end my letter by saying that you are always in everyone's heart that knew you. I don't think I go through a day without thinking about you at some point. You are missed terribly and we all feel a sense of emptiness inside. Thank you for the talk we had just two weeks before you died in which you opened up for the first time to me. I will always regret not being able to get to know you better and your time on this earth being so shortened. You will always be on my mind and in my heart. I don't think that anyone will ever understand why you jumped off that bridge, but unlike Mom, I'm not going to focus on that. She tries to blame herself and think that there was something she could have done to prevent it. Well, I guess only you can be the judge of that, but I try to tell her that she shouldn't deal with your death in that way. Even though I am steadily moving on with my life, I want you to know that I will never forget you. I love you.

Your sister,
Emily

Communicating with Extraterrestrials

Daniel Smolyar
Wheaton High School
Wheaton, Maryland

Introduction

The idea that life, especially life with intelligence, might exist in other parts of the universe is a very old one and can be seen in writings as far back as fifth century BC in the writings of Metrodorus of Chios and Lucretius. These early ideas were based on an intuitive belief in the enormity of the universe and in what is now called the mediocrity principle, namely, that there is nothing special about the Sun, the Earth, and the human race.

While interest in the question of extraterrestrial life is at least as old as historical civilizations, the modern SETI (Search for Extra-Terrestrial Intelligence) era can be defined as beginning in 1959. In that year, Cornell physicists Giuseppe Cocconi and Philip Morrison published an article in *Nature* in which they pointed out the potential for using microwave radiation to communicate between the stars.

Presently, the SETI Institute is working on project Phoenix and the SETI league is working on project Argus. Both projects attempt to find evidence of intelligence elsewhere in the universe by searching for microwave signals.

Scientific Rationale

The sun is one of 2×10^{11} stars of the galaxy (the Milky Way), and there are about 10^{11} galaxies in the visible universe. The universe is always expanding and started with the big bang about 15×10^9 years ago. Every part of it is made of the same 92 chemical elements and obeys the same laws of physics. So the probability that there is life on other planets is high.

In the early 1960's while working as a radio astronomer at the National Radio Astronomy Observatory in Green Bank, West Virginia, Dr. Frank Drake developed an equation to estimate the number of advanced technological civilizations currently active in the Galaxy.

The Drake Equation: $N = R \cdot f(p) \cdot n(e) \cdot f(l) \cdot f(i) \cdot f(e) \cdot L$, where,

N = The number of communicative civilizations.

R = The rate of formation of suitable stars.

- $f(p)$ = The fraction of those stars with planets.
- $n(e)$ = The number of "earths" per planetary system.
- $f(l)$ = The fraction of those planets where life develops.
- $f(i)$ = The fraction life sites where intelligence develops.
- $f(e)$ = The fraction of planets where technology develops.
- L = The "lifetime" of communication civilizations.

With this equation, it is estimated that N equals about 200,000 stellar civilizations, that is, about one advanced civilization per 10^6 stars. The need to search at least 10^6 stars is why supporters of the Drake equation say that radio searchers have not yet produced any positive results.

However, the uncertainties of all the factors in the equation are very large, thus there is no unique solution to this equation. It is a generally accepted tool used by the scientific community to examine these factors.

Project Phoenix

Project Phoenix is the world's most sensitive and comprehensive search for extraterrestrial intelligence. Phoenix began observations in February 1995. It is an effort to detect extraterrestrial civilizations by listening for radio signals that are either being deliberately beamed our way or are inadvertently transmitted from another planet.

Thanks to its long history of cooperation with NSA, the SETI Institute is able to capitalize on a \$58 million government investment representing decades of work by scientists and engineers. NSA had completed less than a year of a planned ten-year SETI experiment when Congress, under strong pressure for deficit reduction, terminated the observations. Because the equipment and procedures were still in a ramp-up phase, not even one-thousandth of the intended search had been conducted.

There are about 1000 stars targeted for observation by Project Phoenix. All these stars are within 200 light-years distance. This project will take approximately five years to complete.

Given so many targets to choose from, scientists on the project have chosen to concentrate on those stars from which a signal would be strongest, on the nearest stars, and on those stars that are similar to our sun, near which is found the only known example of life. For those stars like the Sun, the Phoenix Project scientists have also gone two steps further. They have chosen to concentrate on the older stars (because they expect that advanced life takes a long time to evolve) and the single stars among those (because binary star systems--two stars in orbit around one another--cannot have planets in stable orbits that will endure the gravitational effects of the companion stars). The stars comprise three distance samples, each having a different character, in order to allow various stellar environments to be examined.

Because millions of radio channels are simultaneously monitored by Phoenix, most of the “listening” is done by computers. Nonetheless, astronomers are required to make critical decision about signals that look intriguing.

Phoenix looks for signals between 1000 and 3000 MHz. Signals that are at only one spot on the radio dial (narrow-band signals) are the “signature” of an intelligence transmission. The spectrum searched by Phoenix is broken into very narrow 1 Hz-wide channels, so two billion channels are examined for each target star.

Project Phoenix will use the largest radio telescopes on earth, including the Parks 210-foot telescope in Australia, the Mopra 22-meter telescope, the 140-foot telescope in West Virginia, and the 1000-foot Arecibo telescope in Puerto Rico.

Project Phoenix also has to deal with man-made interference. As of mid-1996, Phoenix had examined about one-third of its targets, but found no evidence of extraterrestrial transmissions.

Project Argus

Perhaps the most ambitious radio astronomy project ever undertaken without Government equipment or funding, Project Argus is an effort to deploy and coordinate roughly 5000 small radio telescopes around the world, in an all-sky survey for microwave signals of possible intelligent extraterrestrial origin. When fully operational, Project Argus will provide the first-ever continuous monitoring of the entire sky, in all directions in real time.

Project Argus is a key effort of the SETI League, Inc., a membership-supported, non-profit, educational and scientific corporation. The League was established in 1994 to further the scientific search for extraterrestrial intelligence. The SETI League is currently developing the necessary hardware, software, protocols and procedures for distribution to its members worldwide. The search phase of Project Argus began with five operational radio telescopes on Earth Day, April 21, 1996.

Project Argus will employ small, quite inexpensive amateur radio telescopes, built and operated by SETI League members at their individual expense.

A typical amateur radio telescope can be built for a cost of a few hundred to a few thousand dollars, depending upon the expertise of the builder. Only five thousand of these smaller instruments are necessary to provide full sky coverage. The equipment, although of modest sensitivity, will still be capable of detecting microwave radiation from technologically advanced civilizations out to a distance of several hundred light years.

Other Forms Of Communication With Aliens

It is estimated that there are about 2×10^{20} stars in the known universe. Therefore, the probability of intelligent life more highly evolved than our own is overwhelmingly high. Then the question that arises is why it is not communicating with us. There are

several possible answers; one is that there is no intelligent life, or that there are communication signals virtually everywhere, but we are not yet intelligent enough to recognize them as such. So far, the only method that SETI organizations use to try to pick up extraterrestrials signals is radio telescopes.

Electromagnetic signals, however, are in several ways less than ideal for communication over light year distances. They require very large amounts of energy, and some of the signals are absorbed by the “dust” in interstellar space and by earth’s atmosphere. In addition, the receiving entity must know where in wavelength and in which direction to look.

It is being proposed that there are other types of signals. When an atom or molecule is in an excited state it eventually decays, normally emitting a photon. There is some half-life of the excited state, and the probability of emission in any given direction is normally uniform over 4π steradians. It is proposed that it is possible to change the instantaneous probability of photon emission in a specific direction – while leaving the mean probability of emission in that direction unchanged. It would be expected that the signal source would be in a straight line, or nearly so, with the atom or molecule and the direction of emission. For discussion purposes these signals will be called emission influence (EI) waves. It is being proposed that scientists could pick up these EI waves.

However, this is just a hypothesis and has not been tested yet.

Alien Communication With Us

For decades people have reported seeing UFOs that were believed to be from other planets. But the absence of concrete evidence, the overwhelming number of fake pictures, and fanciful names like “flying saucer” have deepened the reluctance of professional scientists to take the UFO seriously. Only a few have taken the trouble to investigate this phenomenon with no results. It has been speculated that aliens have been trying to communicate with earth for centuries. There are more than 1000 reported cases of UFOs in the U.S. alone, but there are so many fake pictures that it is hard to take this subject seriously.

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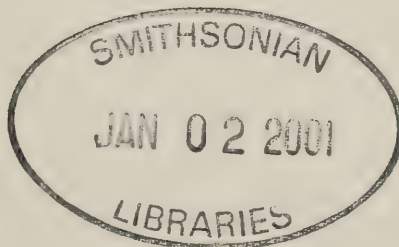
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A Word from the Editorial Staff

1998 was the Centennial Year for the Washington Academy of Sciences. WAS celebrated with several events and special projects, which are outlined in Dr. C. R. Creveling's President's report in this issue. In this new century of WAS, the Journal of the Washington Academy of Sciences will strive to honor the past and anticipate the future. Upcoming issues include articles on electromagnetism, historic scientific figures in Washington, DC, and trans-Pacific culture exchange, indicating the broad interests of our members and readers. The editors will be abstracting events and articles from past issues of JWAS to remind us of the fascinating and noble lineage of our organization.

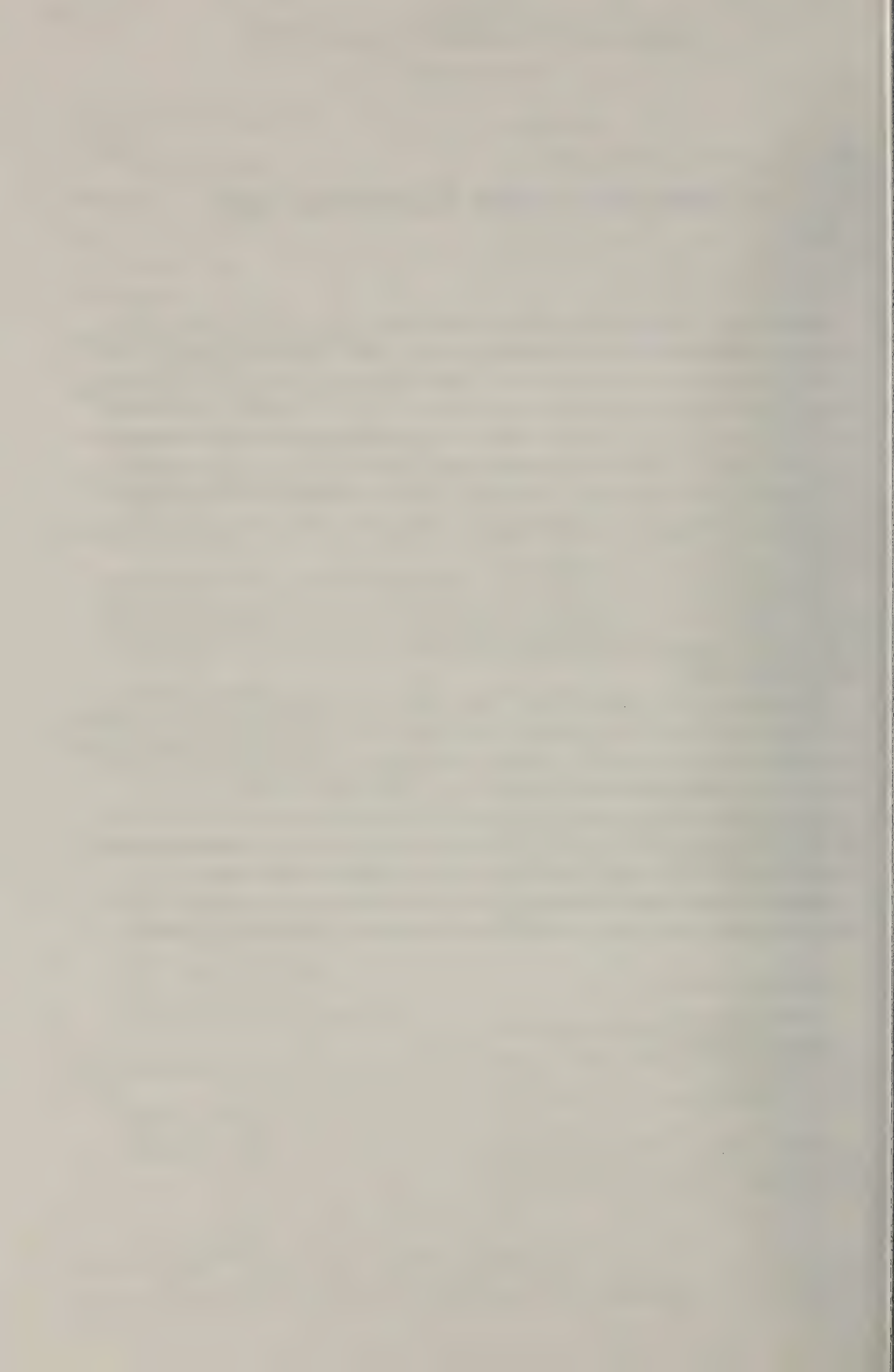
We will also be presenting current news about WAS members. To that end, we are asking members to submit information about awards received and appointments made, for publication in a current news section of the journal. Please send information to the JWAS mailing address.

The editorial staff is seeking WAS Fellows who wish to participate in the publication of the Journal by reviewing manuscripts in their fields. The Journal receives scores of manuscripts each year, and they all require peer reviewers. Please contact the Journal (by mail), indicating your interest and specifying your area of expertise.

This issue includes an account of the May 1998 Awards Banquet, with photographs, and the 1998 President's Report; and the obituary of Past President and long-time Board member Grover Sherlin; and a biography of chemist Elisabeth Weisburger.

On behalf of the Board of Managers and all members of the Academy, we thank each of the contributors to the journal for their continued interest and their patience.

Marilyn R. London
Cyrus R. Creveling
Thomas Bottegal



President's Report on the Academy for 1998

Cyrus R. Creveling
Technology Development
National Institute of Diabetes, Digestive and Kidney Diseases

The Academy has taken many opportunities not only to celebrate our one hundred years of service to the Washington Metropolitan scientific community but also to expand our public image and strengthen our ties with our affiliated societies. We have accepted as affiliates two additional societies, the District of Columbia Chapter of American Women in Science and the World Future Society. We have expanded our international connections with new Fellows from Russia, Spain, the Republic of Georgia, Germany and Canada. We have added 10 new domestic Fellows and 15 new members. I want to thank the members of the Board of Managers who have worked hard and diligently to make this a successful year. As my term of office comes to a close I would like to thank Rex Klopfenstein and his work as chair of the nominating committee, Jim Spates for work on the by-laws, and, of course, Norman Doctor and Elaine Honig who managed to keep the office functioning. Marilyn London and Eric Rickard are carrying out the arrangements for the awards banquet this year. Marilyn London has also agreed to assume the role of Editor of the Journal. Finally the Academy and I are especially grateful to John Proctor and his centennial committee for engineering so many successful centennial events. In keeping with the career of our founder, Alexander Graham Bell, the Academy has pursued the theme of communications. The following events have marked 1998 as a year of communication.

Music as a Means of Human Communication The year began on March 20th with a centennial concert and reception at the National Presbyterian Church showcasing the Fairfax Chorus under the baton of Dr. Douglas Mears. The Chorus performed a magnificent concert of Duruflé's Requiem and Bernstein's Chichester Psalms. Dr. Mears gave a pre-concert lecture on the importance of music as a means of human communication. Following the concert the chorus provided the Academy with a bountiful reception. The Academy is grateful for the cooperation of Dr. Mears and to Carol Dunlap, Managing Director of the Fairfax Choral Society.

Philadelphia Conference of AAAS The Washington Academy was represented by the former President of the Academy, Dr. Frank Haig.

Washington Academy of Sciences: Past, Present and Future Dr. Ellis Yochelson wrote a masterful essay on the early years and Presidents of the Academy which was published in pamphlet form and in the Journal.

Hovercraft Competition The Junior Academy, under the leadership of Dr. Allen Barwick, sponsored the Annual Hovercraft Competition, which is traditionally held on the first Sunday in May at the Wheaton Ice Skating rink. The competition includes radio-controlled and human-powered hovercraft events. In the last competition three high schools placed: Quince Orchard, Maret, and Wilson High Schools. On December 13, 1998 a meeting was held at the Tompkins School of Engineering, George Washington University for high school students, teachers, parents, and engineering mentors to plan the 9th Annual Hovercraft competition. Engineers were present to present the principles of hovercraft design. A working remote-controlled hovercraft was available that students were welcomed to fly.

A Gala Birthday Party On Wednesday, May 27th the Academy held its Annual Awards Banquet at the Bethesda Naval Club. However, this year was different. In response to the desire of the board, all of the Awards were presented to persons for outstanding lifetime careers. After a bountiful meal and the cutting of the Academy's Birthday Cake, Dr. Rita Colwell presented award certificates to an impressive list of persons. They included:

The Bernice Lambert Award for the outstanding science teacher at the High School level was presented to Dr. William Allen Barwick of the District of Columbia School System.

The Leo Shubert Award for the outstanding science teacher at the college level was given to Professor Emeritus Samuel Massie, of the Department of Chemistry at the United States Naval Academy.

The award for outstanding contributions to Behavioral Science was presented to Dr. Jane Goodall of the Jane Goodall Institute of Silver Spring, Maryland.

The award for outstanding contributions to the engineering sciences was presented to Dr. Walter R. Beam for his contributions to industry, government, and education.

The award for outstanding contributions in the Physical Sciences was presented to Dr. Mark Spano of the Naval Surface Warfare Center in recognition of his contributions over the past decade to the experimental control of chaos.

The award for outstanding contributions to computer science was presented to Dr. Robert Kahn and Dr. Vinton Cerf. While no single inventor is responsible for the "Internet" it is agreed however that Dr. Kahn and Dr. Cerf are foremost among the "Internet pioneers".

The award for outstanding contributions in the Mathematical Sciences was presented



Dr. Allen Barwick (left) receives the Bernice Lambert award for outstanding science teacher at the high school level from President Rita Colwell and Dr. C. R. Creveling.



Dr. Colwell congratulates Professor Emeritus Samuel Massie of the U.S. Naval Academy on receiving the Leo Shubert Award for outstanding science teacher at the college level.



Dr. Walter Beam receives the WAS award for outstanding contributions to the engineering sciences from Dr. Colwell.



Dr. Mark Spano of the Naval Surface Warfare Center receives the award for outstanding contributions in the physical sciences from President Colwell.



President Colwell presents Dr. Robert Kahn with the award for outstanding contributions to the field of computer science. Dr. Kahn and Dr. Vinton Cerf were given this award for their pioneering work on the development of the Internet.



David Kotz accepts the award for outstanding contributions in the mathematical sciences on behalf of his father, Professor Samuel Kotz of the University of Maryland. Professor Kotz was in Russia at the time of the Awards Dinner.



The award for outstanding contributions in the biological sciences is received by Dr. Fenner A. Chace of the Smithsonian Institution.



Dr. Ellis L. Yochelson is presented the award for outstanding contributions to the history of science and technology by Drs. Creveling and Colwell.



The Honorable Gilbert Gude receives the award for outstanding contributions to the environmental sciences from President Colwell.



Dr. Joseph Edward Rall is presented with the award for outstanding contributions to public health.



Dr. Grace Ostenso is congratulated on receiving the award for outstanding contributions to technology.



Colonel Thomas Doeppner, former Vice President for Affiliate Affairs, is congratulated by President Colwell for having his name added to a plaque honoring outstanding service to the Academy.



Past Presidents attending the May 1998 Awards Dinner. Back row: Walter J. Boek, John S. Toll, Cyrus R. Creveling, Frank R. Haig, James E. Goff, and John H. Proctor. Seated: John G. Honig, Alphonse F. Forziati, Rita R. Colwell, Jean K. Boek

to Professor Samuel Kotz of the Department of Mathematics and Statistics at the University of Maryland. His son David Kotz accepted the award.

The award for outstanding contributions to the Biological Sciences was presented to Dr. Fenner A. Chace, currently a Zoologist Emeritus at the Smithsonian Institution National Museum of Natural History.

The award for outstanding contribution to the History of Science and Technology was given to Dr. Ellis L. Yochelson from the Department of Paleobiology, Smithsonian Institution.

The award for outstanding contributions to the Environmental Sciences was to the Honorable Gilbert Gude. Gilbert Gude, a previous member of the United States Congress, has been an active force in conservation efforts.

The award for outstanding contributions to public health was presented to Dr. Joseph Edward Rall in recognition of a life time of service as a practicing scientist, scientific director of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), and finally as the Scientific Director of the National Institutes of Health (NIH).

The award for outstanding contributions to Technology Policy was presented to Dr. Grace Ostenso, for her many years of devoted service as a professional staff member of the Committee on Science, Space and Technology of the United States Congress.

The award for outstanding contributions to National Science and Technology Policy was presented to the Honorable Constance Morella for her effective efforts for the promotion of science.

The award for Outstanding and Distinguished Career in Science was presented to Dr. Rita Colwell, President of the Washington Academy of Sciences and now Director of the National Science Foundation. The entire Board of Managers nominated Dr. Colwell.

The evening ended with the address by Dr. Rita Colwell, "Global Climate and Human Health: El Niño and Cholera."

Russian Film Festival On June 11th the Academy was represented by Dr. John Proctor and Dr. and Mrs. Creveling at a reception held at the Savoy Hotel for the directors and artists of the Russian Film Festival.

Science and Engineering Apprentice Program The annual assembly of the student apprentices was held at the George Washington University on August 14, 1998 under the direction of Dr. Marilyn Krupsaw. As in the past many of the conveners who met with the students in one of the study groups and listened to the student presentations were Fellows and members of the Academy.

Centennial Reception for the Affiliated Societies On Wednesday, September 23, many representatives of our affiliated societies attended a reception at AAAS. John Honig and Peg Kay with the help of Elaine Honig made heroic efforts to contact the affiliated with the result that many new faces were present. Dr. Creveling gave a welcoming speech emphasizing the intent of the Academy to assist and meet jointly with the Affiliates whenever appropriate. A very congenial evening was had by all.

Communication Technology Symposium On Monday October 19 the Academy hosted a symposium at the Cosmos Club of Washington entitled "Humanizing and Dehumanizing in Communication Technology. After a brief introduction by C. R. Creveling, five presentations were made by the following participants: Dr. Ronald Manderscheid, Washington Academy; Dr. John H. Proctor, Washington Academy; Paul-Georg Gutermuth L.L.D., Head of Division, German Ministry of Economics, Bonn; Academician Igor M. Makarov, Russian Academy of Sciences, Moscow; and Professor Vil Rakhmankulov, Institute of Systems Analysis, Moscow. A lively and spirited discussion and questions from the audience continued for most of the afternoon. The symposium adjourned to a reception and dinner. At the dinner a Certificate of Fellowship was presented to Paul-Georg Gutermuth. The proceeding of the symposium will be published in the Journal of the Academy. The Academy thanks Drs. Proctor and Manderscheid for their hard work in this symposium.

Historical Society of Washington, DC A joint meeting of the Academy was held with the Historical Society of Washington, DC. Academy fellows Frank Haig, C. R.

Creveling and Peg Kay presented lectures on various aspects of the history of science at the 25 Annual Conference on Washington DC Historical Studies in Washington. The conference was held in the Martin Luther King Memorial Library on Friday, October 30th.

High School Essay Contest As part of the Centennial Year celebrations in keeping with the career of our founder, Alexander Graham Bell, The Junior Academy of Sciences sponsored a High School Essay Contest. Students from the 9th through 12th grades submitted 1000 word essays on topics concerning "Communications Within and Between All Levels of the Biological Hierarchy." Over 100 papers were received from 12 schools. The panel of judges, including Norman Doctor, Rex Klopfenstein, C. R. Creveling, Thomas Bottegal, Allen Barwick, and John Proctor, read them all and with much debate selected 1st, 2nd, and 3rd Prize winners and three Honorable Mentions.

1st Prize: Elizabeth Barnwell, Richard Montgomery High School: "Communications: Koko The Gorilla," Teacher, Beverly Stross.

2nd Prize: Lily Simonson, Richard Montgomery High School: "Equus: The Language of Horses," Teacher, Beverly Stross.

3rd Prize: Anna Burrows, Wheaton High School: "Non-verbal Communication," Teacher, J. Dewey Brown.

Honorable Mention: Lacy Irby, McLean High School: "You've Got a Friend In Me," Teacher, Mrs. Demby Banbury.

Honorable Mention: Emily McDonald, Woodrow Wilson High School: "Dear Ian," Teacher, Mr. Fellows.

Honorable Mention: Daniel Smolyar, Wheaton High School: "Communications with Extraterrestrials," Teacher, Mr. J. Dewey Brown.

The winners of the essay contest were presented with certificates and the prize money at a Reception held at the National Press Club on Monday evening, November 9th. The winners, their families and the sponsoring teachers and friends were present. A speaker, Richard Thomas of Newsweek Magazine, presented a lively lecture on the essential role of the press in democracies. The Academy appreciated the support for the essay contest and reception donated by Vertech, Inc. and CleanScreen Corp.

Marie Curie Centennial A joint meeting and reception was held with the Washington Section of the American Nuclear Society and the Washington-Baltimore Chapter of the Health Physics Society. The speaker, Greta Dicus, Commissioner of the U.S. Nuclear Regulatory Commission, discussed the research by Marie Curie which led to the discovery of radium and polonium by Marie and Pierre Curie one hundred years ago in 1898, the same year that the Washington Academy began. A tour was arranged by the Junior Academy for high school students to visit the AFFRRI reactor on the grounds of the Naval Medical Center. Fifteen students were able to see the reactor. Their

comments at the reception suggested that they were quite excited and impressed by the tour.

American Women in Science On February 10, 1999, the Academy will hold a joint meeting with the DC Chapter of American Women in Science (AWIS) in the AAAS headquarters.

As I write, I realize that there are only a few weeks left before I become one of the past presidents and like Dr. Colwell before me I will present the President's Address in May. The title of my address will be "The Role of Endogenous Estrogens in the Etiology of Human Breast and Prostate Cancer."

Grover C. Sherlin: A Remembrance

Cyrus R. Creveling
Technology Development
National Institute of Diabetes, Digestive and Kidney Diseases

Grover Sherlin was one of the key contributors to the Washington Academy of Sciences over many decades. To our deep regret he passed away at the age of 86, succumbing to arteriosclerotic cardiovascular disease at his home in Hyattsville on January 3, 1999.

Grover Sherlin contributed more of his time and of his resources to the Academy than any single person in its history. He served as its President (1973-1974), Secretary and Treasurer. Since 1981 he spent innumerable hours volunteering his time performing administrative tasks for the Academy. I remember when he sat in the little office at National Graduate University for hours on end, entering each member's information laboriously into the Academy's first Radio Shack computer. He checked all the zip codes, and other information for errors. Grover Sherlin, as the most long-term and conscientious member of the Board of Managers, was given the honor and responsibility to declare a quorum at the beginning of each meeting of the Board.

More recently, he contributed his resources to make a permanent home of the Academy in the new AAAS building a reality. He was one of three patrons of the Academy and, in partial recognition of his contributions, was elected to be Vice-President Emeritus and a permanent Member of the Board of Managers of the Academy for life, the only individual ever so honored. In memory of his many contributions to the Academy, a prize has been named after him to recognize individuals who have contributed most to the Academy.

Grover Sherlin served on the Joint Board on Science and Engineering Education since its inception in 1955 and was its President in 1977-1978. He also served as President of the District of Columbia Council of Engineers and Architects.

Another one of his pet efforts over the last 50 years was his work on behalf of local science fairs. He helped found science fairs and science fair associations in Prince George's County, Montgomery County, Calvert County, Charles County, and St. Mary's County in Maryland, and in the District of Columbia Public Schools. He served as President of the Prince George's County Science Fair Association. Each year, in his honor, that association will award an all expense-paid trip to the International Science

Fair for two freshmen. None of us will forget how he and his wife Margaret contributed many hours at each Science Fair to keep it running and the judges fed.

He was also a lifetime member of many professional organizations, including the American Association for the Advancement of Science, Philosophical Society of Washington, American Geophysical Union, American Society for Engineering Education, Institute of Electrical and Electronic Engineers, National Science Teachers Association, American Society of Plumbing Engineers, District of Columbia Science Fair Association, and the National Geographic Society.

Grover Sherlin was born in Chattanooga, Tennessee, and raised in Little Rock, Arkansas, where he attended Little Rock Junior College. In 1936 he graduated from the University of Arkansas with a degree in electrical engineering. After working on a construction crew for the Bell Telephone Company in Little Rock for eight months and then for the U.S. Army Corps of Engineers, he came to Washington in 1939 to work as a materials inspector for the Panama Canal Inspecting Engineers Office. In August 1947 he accepted a position as a hydraulic engineer at the National Hydraulics Laboratory of the National Bureau of Standards where he remained until his retirement in 1972. However, he continued working at the Bureau as a rehired annuitant until he finally retired in 1976.

His first wife of 36 years, Mary Bruce Sherlin, died in 1973, and his second wife of 20 years, Margaret Mae Sherlin, died in 1995, after a lengthy illness. For 25 years he was a member of the College Park Church of God and cofounder of the Kensington Prayer Group. He is survived by his three children, eight grandchildren, fifteen great-grandchildren, and one great-great-grandchild.

News and Announcements

WAS Past President **Rita Rossi Colwell** became the Director of the National Science Foundation in August 1998. Dr. Colwell was previously President of the University of Maryland Biotechnology Institute and Professor of Microbiology at the University of Maryland. She holds a B.S. in Bacteriology and an M.S. in Genetics, from Purdue University, and a Ph.D. in Marine Microbiology from the University of Washington. Dr. Colwell is active in national and international research and teaching in the areas of marine biotechnology and the molecular genetics of marine and estuarine bacteria.

Past Presidents **Cyrus R. Creveling** and **Rita R. Colwell** were inducted into the World Academy of Arts and Sciences in April 1999. The two were nominated for the honor by John H. Proctor.

Upon his retirement in 1998 from the Naval Research Laboratories Dr. **David L. Venezky** donated funds to the Washington Academy to establish a student award for excellence in science. The first Venezky Award was presented to Mr. Colin Barry at the Chemistry Division of the Science and Engineering Apprentice Program held August 11, 1999 at the Naval Research Laboratories. The title of Mr. Barry's presentation was "Matlab Graphical Interface for Classification Algorithms (MAGICAL): Application to Early Warning Fire Detection". Dr. Ron Shaffer of NRL was Mr. Barry's mentor. Two second prize awards were also selected; Mr. Graham Beaber for "Drug Contamination of Currency" and Ms. Jenelle Baldwin for "Environmental Contamination by Drugs: Inner-city vs. Suburban". Both students served under Dr. David Kidwell of NRL.

Past President **John H. Proctor** was named an Honorary Member of the Russian Academy of Sciences in the spring of 1999.

Member Deaths Reported

1997

Alexander, Dr. Benjamin H.
Baker, Dr. Arthur A.
El-Bisi, Dr. Hamed M.
Forziati, Dr. Florence H.
Freeman, Mr. Alexander F.
Frush, Dr. Harriet L.

Hartmann, Dr. Gregory K.
Schneider, Mr. Sidney
Schulman, Dr. James H.
Sinden, Dr. Stephen Lee
Slawsky, Dr. Zaka I.
Spies, Dr. Joseph R.
Traub, Col. (Ret) Robert
Weissler, Dr. Alfred

1998

Aldridge, Dr. Mary H.
 Axilrod, Dr. Benjamin M.
 Ballard, Mr. Lowell D.
 Herman, Dr. Robert
 Irving, Jr., Dr. George W.

Kessler, Dr. Karl G.
 Mayor, Dr. John R.
 McKenzie, Mr. Lawson M.
 Mizell, Mr. Louis R.
 Sanderson, Dr. John A.
 Specht, Dr. Heinz
 Tousey, Dr. Richard

Benefactors and Patrons (*) of the Washington Academy of Sciences

1997

*Alexander, Dr. Benjamin H. (LF)
 Allen, Dr. J. Frances (EF)
 Aronson, Mr. Casper J. (EMJ)
 Beach, Dr. Louis A. (F)
 Beckmann, Dr. Robert B. (EF)
 Doeppner, Col. Thomas W. (LF)
 Freeman, Mr. Andrew F.
 Glover III, Prof. Rolfe E. (EF)
 *Honig, Dr. John G. (LF)

Klopfenstein, Mr. Rex (F)
 Manderscheid, Dr. Ronald W. (LF)
 Perros, Dr. Theodore P. (F)
 Specht, Dr. Heinz (EF)
 Tamargo, Dr. Juan (NRF)
 Tate, Mr. Douglas R. (NRF)

1998

Fearn, Dr. James E. (EFJ)
 Shropshire, Jr., Dr. W. (LF)

Membership Statistics

Category	N	%
Fellow	172	34.9
Non-Resident Fellow	42	8.5
Emeritus Fellow	121	24.5
Life Fellow	46	9.3
Member	97	19.7
Emeritus Member	12	2.4
Life Member	3	0.6

Location	N	%
Maryland	227	46.0
Virginia	95	19.3
Other States	79	16.0
District of Columbia	63	12.8
Foreign	22	4.5
Address unavailable	7	1.4

Elizabeth Weisburger: More Than a Chemist

Melissa Mahon and Dr. Nina Matheny Roscher
Department of Chemistry
American University
Washington, DC 20016-8014

Abstract

“A chemist has to have endurance, intelligence, a sense of responsibility and, well, strength, and some curiosity too,” (Weisburger, 1996). All of these traits are the characteristics that Elizabeth Weisburger has and which enabled her to thrive in the field of chemistry and especially chemical carcinogenesis. Her devotion to this field and her career have led to numerous awards and honors. Weisburger’s life as a chemist also includes her work as a teacher, editor, and, recently, a consultant.

“A chemist has to have endurance, intelligence, a sense of responsibility and, well, strength, and some curiosity too,” (Weisburger, 1996). All of these traits are the characteristics that Elizabeth Weisburger has and which enabled her to thrive in the field of chemistry and especially chemical carcinogenesis. Her devotion to this field and her career have led to numerous awards and honors. Weisburger’s life as a chemist also includes her work as a teacher, editor, and, recently, a consultant (*The Capital Chemist*, 1996). Retired since the beginning of 1989, Weisburger has “been busier than ever” as she is the social chair in the division of Chemical Health and Safety, American Chemical Society, and also consults when needed (Weisburger, 1996). Her long career is growing even more remarkable, as she still participates in numerous societies and activities relating to the field.

Elizabeth Weisburger was born on April 9, 1924, in Finland, Bucks County, PA. Shortly after she was born, her parents, Raymond Samuel Kreiser and Amy Elizabeth (Snively) Kreiser moved back to Lebanon County, PA (Grinstein, 1993). From that time until the time Weisburger went to graduate school, the family grew with new children, totaling ten Kreiser children in all. As Weisburger would succeed in the field of chemistry, some of her siblings would also major in science fields.

Weisburger’s education came from Lebanon Valley College, where she received a small scholarship. She majored in chemistry, but was also interested in biology (Grinstein, 1993). In 1944 she received her B.S. in chemistry, and the same year she received a graduate assistantship in chemistry from the University of Cincinnati, where she earned her Ph.D. in organic chemistry, three years later. For her work, Weisburger was awarded an honorary D.Sc. from each institution (Cattell, 1994).

Before Weisburger began her chemistry career, she held other jobs, not related to the chemistry field, during the summers. She started her working career making men's pajamas in Lebanon, PA (Weisburger, 1996). The next summer she began making women's dresses. The following summer Weisburger worked at a poultry packing establishment. The summer before Weisburger went to graduate school, she worked at the Bethlehem Steel Forge Plant. There she inspected airplane cylinder barrels and bridge pins (Weisburger, 1996). Working there allowed her to learn about practical metallurgy, since she asked questions about what she was working on (Weisburger, 1996).

Going into chemistry was not easy for Weisburger, giving the prevailing attitudes of both men and women. Weisburger believes, "there is less discrimination now. Probably, the most overt discrimination was in the physics courses I took. I would be the only female and there would be eight to ten other students, all males. So that was about the worst" (Weisburger, 1996). That was during Elizabeth's undergraduate school years, but during graduate school, there was not as much discrimination due to the fact that it was wartime; consequently, women were accepted with graciousness (Weisburger, 1996). This was the same time that Elizabeth received her assistantship to attend the University of Cincinnati. Even today Elizabeth believes that "women were not promoted or given the laboratory chief jobs at NIH that they should have been" (Weisburger, 1996).

Discrimination also played a role in the life of Weisburger's sister. Her sister majored in chemistry, but was discouraged when she was not allowed to have a lab bench to do her research project because the benches were reserved for the men (Weisburger, 1996). Later in life she married a physicist/electrical engineer. In spite of the discrimination and the times, both male and female siblings of Weisburger found careers and jobs in various branches of chemistry, as well as in other science fields. A brother of Weisburger's became an analytical chemist and works at Hershey Medical Center, while another brother became a biochemist. Two other siblings majored in biology, one becoming a Navy captain.

Not only do science jobs and careers abound within her immediate family, but they are also prevalent in her own family and her siblings' families. Her siblings' children have become electrical engineers, computer specialists, physicians, and teachers in science fields. Weisburger's own children include a son who is a pathologist, a daughter who is a physical therapist, and another son who is a computer programmer. Weisburger's children were not pushed into the fields they chose, but were encouraged through their own interests (Weisburger, 1996). However, Weisburger's curiosity and interest in chemistry might have helped sparked interest in the fields all of her relatives eventually chose.

Weisburger's long career led to some interesting experiments, exciting discoveries in chemistry, and some interesting trips. Weisburger saw that "chemistry was [a field where] there are lots of new things to be done and discovered" (Weisburger, 1996).

Because of this she chose chemistry as a career. This aspect of chemistry led her to realize that there are many fields that can be applied to chemistry, such as toxicology, patents, and many others (Weisburger, 1996). Because of Weisburger's job in the Public Health Service, she became very knowledgeable about the subjects she worked with and she was often called upon to be a possible expert witness or reviewer. Her life as a consultant since she retired has led to some very interesting side trips, such as flying to Seattle to appear in court (Weisburger, 1996).

During Weisburger's career, she had many achievements. In 1973, she received the Public Health Service Meritorious Medal, for her work as a commissioned officer in the U.S. Public Health Service. Weisburger had always been interested in the mechanism whereby environmental chemicals cause mutations and/or cancer (*The Capital Chemist*, 1981). This involved one of her primary research efforts directed at elucidation of carcinogenesis by aromatic amines and aminoazo dyes. She and her coworkers also worked with metabolism and activation of other amines. Weisburger was also involved in the selection of environmental chemicals to be tested for possible carcinogenic activity. These tests were among the first to show the carcinogenic effect of certain pesticides, textile flameproofing agents, anti-knock agents, and others (*The Capital Chemist*, 1981).

All of these research efforts were recognized by the Hildebrand Award in 1981, given by the Chemical Society of Washington. During this year, Weisburger also earned the Garvan Medal from the American Chemical Society. Weisburger, who held the rank of Captain, also received the Distinguished Service Medal of the U.S. Public Health Service in 1985. Two years later she received the Professional Service Award from the Washington Professional Chapter of Alpha Chi Sigma, and two years after that in 1989 she was awarded the Distinguished Scientist Award from the D.C. Chapter of the Society for Experimental Biology (Grinstein, 1993). In 1996, Elizabeth received the Stokinger award from the American Conference of Governmental Industrial Hygienists for her "contribution to the occupational health and safety profession and for her achievement in the broad field of industrial and environmental toxicology" (*The Capital Chemist*, 1996).

Another great achievement of Weisburger was her involvement with the Bioassay Program (Weisburger, 1996). Elizabeth states, "The thing that was perhaps the most influential [in her life] was helping to start the bioassay program at the Cancer Institute. In the bioassay program we tested compounds to see whether they might be carcinogens. I was responsible for picking out the compounds to test and get the information" (Weisburger, 1996). Another achievement of Weisburger's relates to her service and commitment to help others. She served on the Board of Trustees at Lebanon Valley College, including as its chair. In recognition of her service and support, there is an Elizabeth Weisburger Indoor Track at Lebanon Valley (Weisburger, 1996). "There was a fund drive years back for a physical education building, when they opened the building

and had the dedication, [Weisburger] found out that they had named the indoor track after her" (Weisburger, 1996). Having a track named after her was just another honor she gained by working in the chemistry field.

After all of these awards and accomplishments and forty years at the National Cancer Institute, Weisburger retired, but she still remains quite involved in the chemistry and science world. Her days are filled with many different activities and types of work, as she is a member of the American Society of Biological Chemists, Royal Society of Chemistry, American Association for Cancer Research, Society of Toxicology, and many other chemical and toxicology societies. Weisburger has authored or co-authored numerous technical publications and serves on the editorial boards of several journals (*The Capital Chemist*, 1981). She reviews numerous reports and does a lot of editing for various people and societies, such as the American Institute for Cancer Research (Weisburger, 1996).

Weisburger's life does not just revolve around chemistry, she greatly enjoys the outdoors (Weisburger, 1996). She has done quite a bit of hiking and still continues to do so. She is active in clubs relating to the outdoors world, as she aids in the maintenance of hiking trails (Grinstein, 1993). Elizabeth likes to do crossword puzzles, because they are similar to complicated reactions. She enjoys baking, because it also is similar to laboratory work, (Weisburger, 1996).

If the past could be relived Weisburger would still choose to be a chemist (Weisburger, 1996). She states, "One of the problems is the public image of chemistry in that people think that it is something associated with toxic waste and things of that type. Chemists are currently having a harder time finding jobs, but there are so many things that chemists can go into—patent law and information systems, library work, toxicology, biotechnology and selling chemicals. There are lots of opportunities for chemists" (Weisburger, 1996). Elizabeth Weisburger definitely found the opportunities and put her knowledge to work. Her career as a chemist allowed her to have influence over certain things, such as the Bioassay Program. She has had a long career as a chemist, but her work in the field still continues today. She has achieved in the field she chose to study and expanded her accomplishments many times over with the work she has done; work that was not easy for a woman. Being a successful woman chemist, alone, is a great accomplishment. As Weisburger continues to hike and figure out crossword puzzles, the chemistry field she has retired from has not quite been put to rest.

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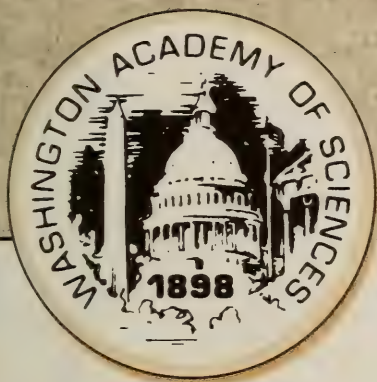
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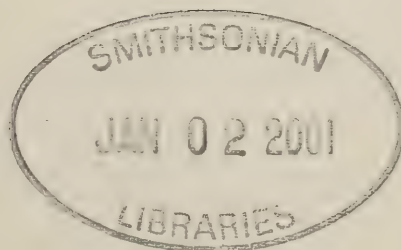
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A Word from the Editorial Staff

This issue of the Journal includes a report from Dr. Frank Haig, former president of the Academy, on the Global Symposium on Information Technology of Futuroscope held in March of 1999 in France. In upcoming issues, we will have more reports from and papers presented at international symposia on the impact on information technology on global communications.

We also have an article by Paul Arveson on the concept of *gratuity* as applied to several fields of science.

The third article is a historical perspective on the family of Edward Kübel, who was an instrument maker in Washington in the 19th century. We are pleased to publish this article, written by Silvio Bedini, as part of the celebration of the 97th birthday of Frank A. Taylor, one of Kübel's most successful grandchildren.

The editorial staff is still seeking WAS Fellows who wish to participate in the publication of the Journal by reviewing manuscripts in their fields. Please contact the Journal (by mail), indicating your interest and specifying your area of expertise.

On behalf of the Board of Managers and all members of the Academy, we once again thank each of the contributors to the journal for their continued interest and their patience.

Marilyn R. London
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The Global Symposium on Information Technology of Futuroscope

A Summary by The Rev. Frank R. Haig, S.J.
Representative from the *Washington Academy of Sciences*

The Club of Rome, the European Commission, and UNESCO sponsored a meeting entitled The Global Symposium on Information Technology of Futuroscope March 1-5, 1999. The topic of the convention was Thinking Global, Feeling Local : Connectivity in the Information Society. The Washington Academy of Science was invited to send a representative. Dr. Frank Haig, a former president of the Academy, was chosen to represent the Academy.

From Monday, March 1, until Friday March 5, 1999 some 200 international scholars, technologists, and interested people gathered just outside of Poitiers, France, to discuss the effects of the new global information society that is currently forming world wide. Some 1000 visitors clicked into the website of the congress as it progressed. The objective of the symposium was to develop proposals of concrete projects, supported by attractive presentation techniques and materials. The principal themes were: governments and the globalization of the on-line citizenry; knowledge and training: networking education and educating networks; and business in the 21st Century: financial and technical infrastructures of the networked economy. The location of the meeting has the bizarre name of Futuroscope. Futuroscope is, first of all, a park modeled on Disneyland. It is, secondly, an industrial area that would like to imitate Silicon Valley. It is, finally, a dream of a place that can be a center of innovation, technological change, and job creation.

The Magic Triplet

Three words dominated the meeting: Europe, information, and sustainability. The experiences of France, Germany, England, the USA, South Africa and other lands were heavily discussed but the emphasis was on creating a world that would be influenced by European values. The emotional commitment to such structures as the European Commission, the European Union, and the like was always evident in the conference presentations.

The point of the meeting was to consider the society being formed worldwide by the information revolution. Business was being restructured. Governments are being

refashioned. Language and culture are being recreated; all as influenced by the information society into which the world, unconsciously but rapidly, is moving. Perhaps the major coloration that came from having such a meeting on the continent was the emphasis on sustainability. We cannot keep being as widely irresponsible as we are in energy and resource usage or there will be no world for coming generations to inherit. Even the imposing new reality of the Internet in meaningless without healthy people to log on to it. Although the green movement was not mentioned since this meeting was not as such political, the shadow of its presence fell across every discussion. The Club of Rome's fixation on the limits of growth was very apparent.

The Prevailing Mood

The tone of the meeting reminds one of the fortunately fictitious gentleman who drowned recently in a crowded pool because, as he went down for the third time, he called for help in Esperanto and no one understood him. We are all, the conference speakers seemed to feel, passengers on a cruise ship wildly hurtling through space where no one is at the rudder so that cannot be sure at what place we will arrive or whether we will be happy to be there when we dock. This situation of desperate and onrushing confusion as the information age overwhelms us is what the meeting wanted to consider. For example, an earnest but worried authority, Mr. Didier Livio from France, agonized over the new concept of work. In the old days those who had a job came to a certain place, the office, at a certain time, nine to five, and produced a definite output. Nowadays, the same workers take their portable computers and mobile telephone and set of fax numbers and go where they please whenever the spirit moves them, and produce an output that is no longer clearly defined. Just how a manager directs this new group of employees and produces an esprit de corps is no longer known.

An Expected but Unsettling Overtone

An American observer at the meeting could not miss a certain anxiety expressed by many participants as to the dominance of the colossus from across the Atlantic, namely, the United States, in this information age under formation. The Internet is a prime example. America started it, after all, and now most messages from anywhere to anywhere find themselves routed through the Commonwealth of Virginia.

The concern goes beyond the Internet. One television producer from France, Gilles du Jonchay, pointed out that ninety percent of the images that appear in the news reports of international television are the work of two companies, Reuters of England and APTV of the United States. The explanation is not Anglo-American cultural imperialism but the rigidity of the control by the French government and the labor union of French journal-

ists. The forces hobble the one French organization in the field, Agence France Presse, and have brought it into a state of crisis. Still the effect is a cultural dominance.

The plenary sessions were frequently broken up into seminar type formats. In one of those afternoon meetings the opposition to the United States was so intense as to threaten for a time the stability of the group. The charges against the United States began with a distortion of American foreign policy by the needs of the Cold War which led the U.S. to support monstrous dictatorships in Africa, for example, because the dictators in question were buyable. They would, for a price, stand with the U.S. against the Soviet threat. An example would be Mobutu, who was supported by America for years even though everyone knew he oppressed his people. No one mentioned that Mobutu's successor, L. Kubila, does not seem to be much of an improvement.

The next objection concerned American foreign aid programs. Experts in Washington devise projects that they think will help underdeveloped people. They then consult the governments involved and the two impose some program on a local community. No regard is given as to sustainability so that when the program ends and no special funding is available, the activity collapses and no effect is seen. No one thinks to ask the community what it needs and wants and will support. An example was given of a wonderful attempt to provide fresh clean water by digging a well. The community, however, had used the local stream for its water supply and built up an entire culture around the gathering at the stream for social interaction. Nobody used the famous well. What that community wanted, as a matter of fact, was a soccer field to provide recreation for the young boys who otherwise went chasing after the young girls and kept the teenage pregnancy rate high.

The Internet itself was another example. The language of the Internet is English. So the small villages in Africa find their local cultures obliterated by the communications revolution. Actually, a use of somewhat old-fashioned technology can avoid this effect. In Zimbabwe, a large program is underway using portable radio transmitter. These transmitters are taken to local villages and then the local people are encouraged to produce their own show in their own language.

The final critique of America really involved all the developed countries. It centered on the boxes and boxes of guns America and the West sell to underdeveloped nations so that oppressive governments and their enemies can wipe out the defenseless citizens.

A real surprise came up, however, when the subject of the Peace Corps arose. Even the harshest critics of America voiced profound admiration of the Peace Corps volunteers. Here is a program, the critics noted, that is ideal. The Peace Corps volunteers really get down with the people and live among them and listen to them. The program is even for America's critics a model of what can be done by sensitive individuals.

The Challenge of the New

The representative from Bertelsmann AG gave one of the most fascinating examples of the challenges of the new age. He recalled in his address that, when Amazon.com began its meteoric rise, the executives at Barnes and Nobles looked at the new company and concluded that the selling of books on-line would never go anywhere. People, after all, like to browse and to meet other readers interested in the same subjects that they are. They forgot the primary lesson of all market research that convenience is the dominant factor. Now Bertelsmann has a one half share in the company.

A Look into the Future

The global economic order today, one of the handouts distributed at the meeting insisted, is too much concerned with the short term. The result is the rich get richer and the poor get poorer and wealth has many ways to avoid its use in socially and environmentally responsible ways. The European approach has a way out.

First, Europeans have a great confidence in government and its ability to intervene effectively in the structuring of society. The information age into which we are moving must respect the many cultures that exist, a problem where Europe has a great deal of experience even if it has not always been happy. Planning for the future must center on sustainability. An uncontrolled and undirected free market does not itself provide the framework for development that is needed. It lacks the social welfare concern that Europe has embodied.

A vision, therefore, that is socially responsible, culturally sensitive, and centered on sustainability has a real chance to build a society that can survive for generations to come. So the meeting concluded. Next year it is planned to go further.

EDWARD KÜBEL (1820-1896)

Washington, D.C. Instrument Maker

*With Notes on His Descendants
Having Careers in Science and Technology*

Silvio A. Bedini, 4303 47th Street N.W., Washington, D.C. 20016-2449

Summary

In 1849 Edward Kübel, at 29, a professionally trained instrument maker, arrived in Washington from Bayreuth, Bavaria, and was employed by William Würdemann as foreman of his shop for twenty-five years. There he learned the value of interplay between the surveyor or scientist who used the instruments and the craftsman who made them for their specific purposes. Upon Würdemann's retirement in 1874, Kübel advertised the opening of his own shop where he lived in the same Capitol Hill neighborhood at 326-328 First Street N.E. As had Würdemann, in his own shop he too stressed that he offered customized instruments in consultation with the professionals who used them, and modified existing instruments to meet particular requirements.

Kübel's business was carried on by his son Ernest, who eventually moved his shop to the rear of 325 First Street N.E. for a few years before accepting employment in the U.S. Geological Survey's (USGS) own shop. Edward's other son, Stephen Kübel, was engaged by John Wesley Powell, director of the USGS, to create the section that reproduced the Survey's maps by copper plate engraving, which at that time became the standard for the world.

Subsequent generations of Edward Kübel's family also were involved with the application of technology to science in various professions, raising interesting unresolved questions of how families persistently remain linked to variations of the same profession.

The establishment of the United States Coast Survey by President Thomas Jefferson in 1807, followed by the appointment of Ferdinand Rudolph Hassler as the Survey's first Superintendent, had a major impact on the precision-instrument industry in the United States. Hassler, a native of Switzerland, had hoped to see the best precision instrumentation emulated in the United States, but found few if any sufficiently skilled craftsmen available there for full time employment. Accordingly, he sought them overseas and brought highly-skilled European artisans to work in Washington for the Coast Survey, and meanwhile in England he purchased a number of the instruments required for the Survey.¹

Hassler's efforts opened the door to immigration for a number of well trained makers of mathematical instruments from several parts of Europe. Here they continued the traditions of fine craftsmanship of their own country, employing and developing these techniques in the United States to create a totally new tradition of mathematical instrument making. They were in a large part responsible for the demise of individual handcrafting and the development of multiple manufacture of precision instrumentation.

The arrival of foreign-trained instrument makers at the time of government-sponsored scientific endeavors provided a stimulus for the design and production of sophisticated astronomical instruments having scales graduated by original graduation or machine graduation that were required for determining latitude and longitude for national boundary and territorial surveys. Until the middle of the nineteenth century, only one or two American instrument makers were capable of original instrument scales. As a consequence, reflecting circles, sextants, and similar precision instruments requiring graduation had to be sent to Europe or to England, where the invention of Jesse Ramsden's circular dividing engine had initiated the age of mechanical graduation.

As other instrument makers began to reproduce and use the circular dividing engine and trained more craftsmen in its use, precision instruments came into more general use on both sides of the Atlantic. It was not until American makers could purchase or could construct their own dividing engines, however, that they could produce such precision instruments, but even then they had difficulty in competing with European prices.

Hassler's first full time employee in the Survey was William Würdemann (1811-1900) who had been trained in Germany and had emigrated to the United States in 1834. Hired as "Chief Mechanician of the United States Coast Survey" at a salary of one dollar a day, Würdemann remained in the Survey's employment until 1849. He then resigned in order to establish his own shop as "Mathematical and Optical Instrument Manufacturer" to produce astronomical and geodetic instruments for the Survey and American colleges, among other clients. His shop, a small building at the rear of a row of three-story houses which he owned and rented, was situated near his home in Washington at the corner of Delaware Avenue and North B Street on Capitol Hill at the north edge of the United States Capitol grounds.²

The first members of Würdemann's staff were Edward Kübel (1820-1896), designated as his Chief Foreman, and another unidentified workman. Kübel was a native of Bayreuth in the kingdom of Bavaria. Following a standard education in local secondary schools, he served an apprenticeship as a mechanician. Anxious to advance himself in his chosen career, he decided to travel. At the age of twenty-two he sought and was issued a passport in Munich by the "Minister of State and Foreign Affairs of the Royal House of Bavaria in the name of the King." It enabled him to travel to the other states of the Confederation of Germany, as well as to Austria, Belgium, Holland, England and Switzerland for the purpose of perfecting his mechanical skills. Seven years later, on

April 27, 1849, he sailed from Bremen to the United States. Arriving in New York, he made his way to Washington, where he became Würdemann's first employee.³ (Figures 1, 2, 3, 4, 5)

During this period, while Würdemann's shop was producing fine theodolites and zenith telescopes for the Lake Survey, it was often frequented by officers engaged in the various surveys. Among them was Professor Julius E. Hilgard, Assistant in charge of the Coast Survey, with whom Würdemann became well acquainted. Recently Kübel

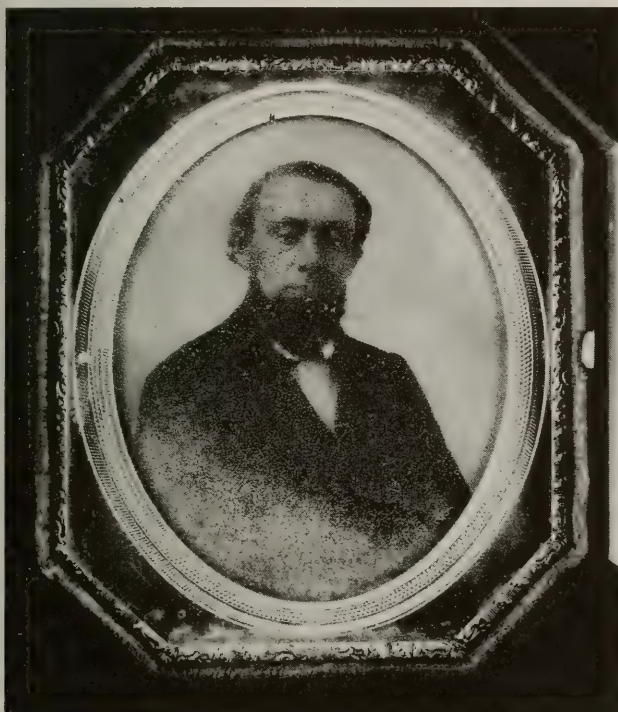


Figure 1. Portrait of Edward Kübel, in his early years.



Figure 2. Portrait of Edward Kübel, in his later years.

had been joined in the shop by Camille Fauth, another employee newly arrived from Germany, and at about this time they were involved in the production of three theodolites for primary triangulation, having circles 20 inches in diameter in fulfillment of a contract with the Coast Survey at a reported cost of \$12,000. Würdemann's attempts to graduate these instruments himself were unsuccessful and finally he had to take them back to Germany to have them graduated there. In response to this constant need, one of Würdemann's first priorities became the design and construction of a new dividing engine for his shop which could cut either degree or centesimal graduations. Kübel constructed it entirely of iron and steel, the base consisting of tripod, cylindrical axis and circle, all made of cast iron. Since Kübel lacked the required theoretical knowledge to complete the engine, however, Würdemann assigned it to George N. Saegmuller, a new employee he had brought from England. Lacking facilities for graduating the engine in his shop, Würdemann took it to Dresden to have it graduated by Gustav Heyde.⁴

In 1853 Kübel married Magdalena Hirtz and on April 22, 1854 they became parents

Figure 3. Passport issued to Edward Kübel of Bayreuth at Munich on October 20, 1842 by the Department of State of the King of Bavaria, permitting him to travel in the States of the Confederation of Germany, Austria, Belgium, Holland, and England for the purpose of perfecting himself in his craft.

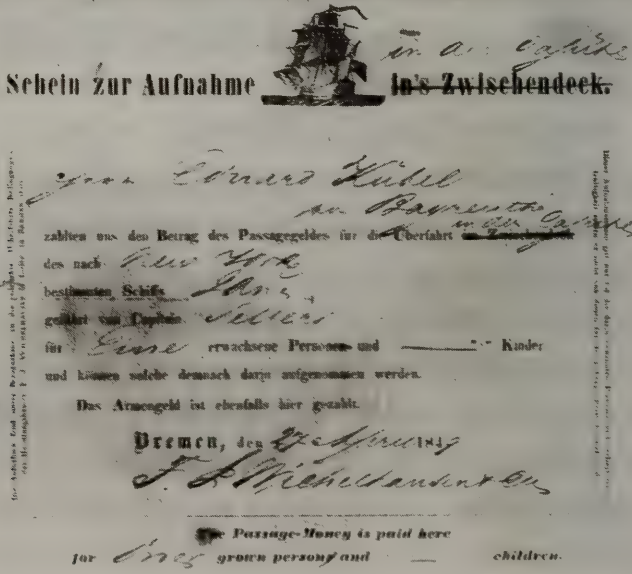


Figure 4. Passage ticket of Edward Kübel dated April 27, 1849 for passage from Bremen to New York.

298. 2731.
Geheimbegertheits-
Hainchen 20. Oktbr. 1842.
Sveierinn
Paul Kugenth, und dem Sammler, reise-
begleitend, 3 April 1843
by 3 April 1843, journey by the Mecklenburg
Graf Hatzfeld in Condition found.
3 April 1843
The King's Privy Council
Approved by the King 1843
The Secretary of State
Cath

Figure 5. Passport issued to Edward Kübel by the U.S. State Department to return to Germany.

DISTRICT OF COLUMBIA, TO WIT
At a Circuit Court of the United States for the District of Columbia, held in the County of Washington, in the City of Washington, on the 11th day of October, 1855, in the year of our Lord one thousand eight hundred and fifty-five, and of the Independence of the United States, the 37th year.
PRESENT
Frederick H. Hensell, Chief Judge.
James S. Hensell, Assistant Judge.
James S. Hensell, Clerk.
In the Record of Proceedings on the same Court, among others, to wit:
Be it Remembered, That heretofore, to wit, on the 19th day of February, in the year of our Lord one thousand eight hundred and fifty-five, at the County of Washington, appeared Edward Kübel, a native of Germany, aged about thirty years, bearing allegiance to the King of Prussia, having emigrated from Prussia, and arrived at Washington, D.C., on the 15th day of June, in the year of our Lord one thousand eight hundred and fifty-five, and in open Court reported himself for NATURALIZATION, and declared on oath, that it was his intention to become a Citizen of the United States, and to renounce forever all allegiance and fidelity to any foreign Prince, Potentate, State, or Sovereignty, whatever, and particularly to the King of Prussia, according to the laws of Congress in such case made and provided.
And now, to wit, on the 12th day of February, in the year of our Lord one thousand eight hundred and fifty-five, appears again in open Court here, the said Edward Kübel, and exhibits to the Court, here, a certificate of his Return and Declaration aforesaid; and it appearing to the satisfaction of the Court, by the oath of William Würdemann, a citizen of the United States, that the said Edward Kübel has resided within the limits and under the jurisdiction of the United States for FIVE YEARS, last past, without having been out of the Territory of the United States during that time, and one year last past, within the limits and under the jurisdiction of this Court; and that during that time, he has behaved as a man of good moral character, attached to the principles of the Constitution of the United States, and well disposed to the good order and happiness of the same.
And the said Edward Kübel in open Court here makes Oath that he will support the Constitution of the United States, and that he doth absolutely and entirely renounce and abjure all allegiance and fidelity to every foreign Prince, Potentate, State, or Sovereignty, whatever, and particularly to the King of Prussia, to whom he was before a Subject.
It is therefore ordered by the Court here, that the said Edward Kübel be ADMITTED A CITIZEN OF THE UNITED STATES; and he is accordingly admitted a Citizen of the United States, according to the laws of Congress in such case made and provided.
In Testimony that the foregoing is truly taken from the Records of the Proceedings of the said Court, I have hereunto subscribed my name, and affixed the seal of the said Court, the 11th day of October, 1855.
Frederick H. Hensell

Figure 6. Certificate of citizenship issued to Edward Kübel, February 12, 1855, Washington, D.C. with William Würdemann appearing as sponsor.

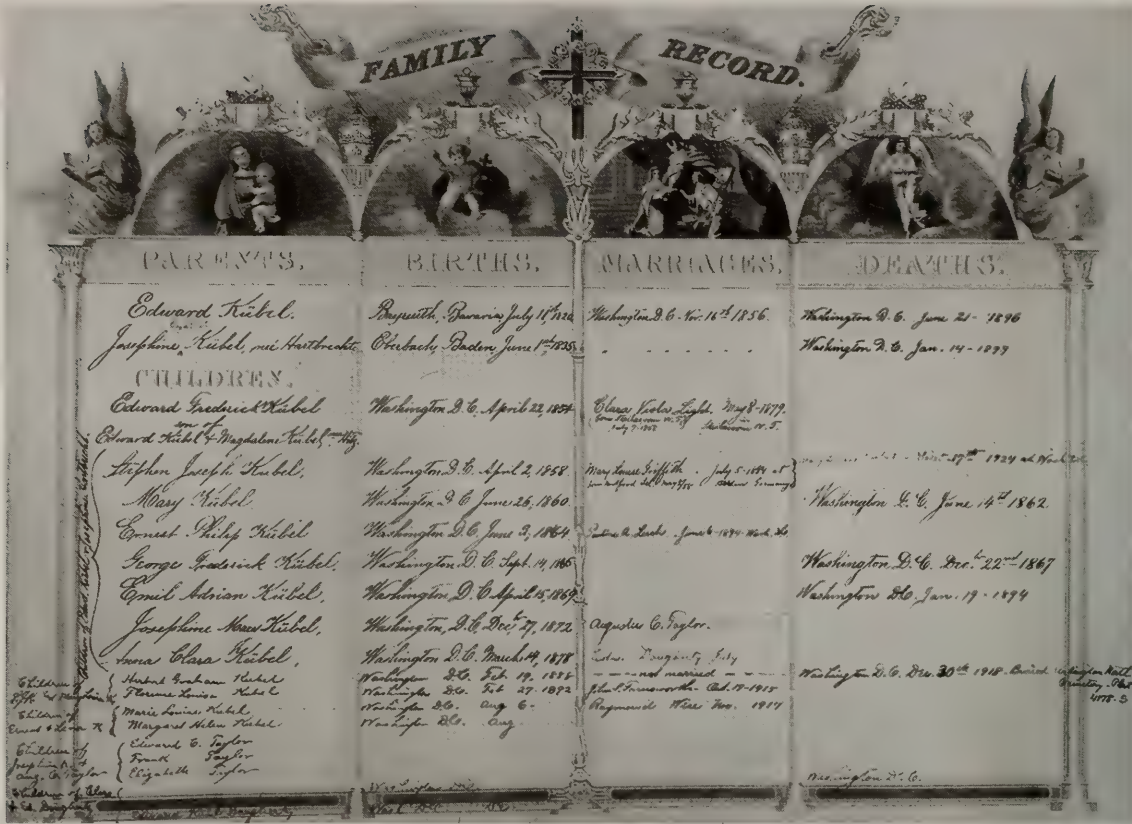


Figure 7. The Kübel genealogical record from the family’s Holy Bible.

of a son, Edward Frederick. In the following year Kübel initiated proceedings for becoming a United States citizen, and on February 12, 1855 he was granted citizenship. Würdemann appeared as his sponsor and testified to his moral character as well as to his required residency within the jurisdiction of the Circuit Court of the United States for the District of Columbia.⁵ (Figure 6)

On November 16, 1856, the widowed Kübel married again, to Josephine Hartbrecht, formerly of Eberbach, Baden, in St. Mary’s German Catholic Church in Washington. In due course they became the parents of four sons, Stephen Joseph, Ernest Philip, George Frederick and Emil Adrian, and three daughters, Mary, Josephine Mary and Anna Clara. Two of the infants, Mary and George each died at the age of two; and Emil, who had chosen dentistry as his career, died at the age of twenty four.⁶ (Figure 7)

On April 11, 1857, Edward Kübel purchased property on the west side of First Street N.E., between C and D Streets North, described as the north half of Lot numbered 8 in Square 684. In the absence of identifying street numbers in the deed or on maps thus far available, it is likely that this was the property known as 326-328 First Street N.E., where in 1874 Kübel would advertise the location of his own residence and instrument-making business.

Although until 1869, while working for Würdemann, Edward Kübel had listed his home address as 343 First Street N.E., apparently in about 1870 he moved his large and growing family to 326-328 First Street N.E. and begun to make modifications to the buildings to accommodate the installation of his shop. In the Washington Directory

for 1870 he is listed simply as "Instrument Maker, 1st between C and D, N.E.," which is judged to refer to his move.⁷

Kübel planned with foresight and timeliness, for in 1874, the year that Würdemann retired, Kübel announced his own shop, advertising in *The American Journal of Science and Arts*:

Edward Kübel

326 and 328 First Street, Northeast, Washington, D.C. For twenty-five years foreman with Wm. Würdemann, continues to manufacture, the class of **Astronomical and Geodetical Instruments** formerly made by Mr. Würdemann.⁸

Kübel's two adjoining houses at 326 and 328 First Street N.E., within walking distance of the offices of the Coast and Geodetic Survey as it was renamed in 1878, served him well, one as the family residence, the other as the shop on the ground floor, with shop supplies and domestic storage on the floors above.

Ten years later the shop, which now employed 7 to 8 skilled workmen and boasted a 4-horse power gas engine supplying power for all the tools, produced a formidable line of surveying and astronomical instruments. Included among the shop's tools was a dividing engine bearing the nameplate of Edward Kübel and believed to have been made by him.

This essential tool of the maker of scientific instruments served the instrument-making Kübels and was last sighted in about 1962 in the shop of a later Washington maker. It would have been a desirable addition to the Kübel tools and instruments preserved in the Smithsonian Institution, which recently acquired Kübel's instrument maker's lathe having the name plate "Vorm August Hamann / J. Goldmann / Berlin." Edward Kübel and his son Ernest used this lathe in the shop at 326-328 First Street N.E., and Ernest continued to use it thereafter for the remainder of his career. After small electric motors became available, Ernest motorized the lathe while carefully preserving the original foot treadle and the rod that connected it to the crankshaft of the lathe. (Figures 8 and 9)

Among Edward Kübel's employees was **Andrew Kramer**, who began to work in Kübel's privately owned shop in about 1886, as an unpaid apprentice. Later Kramer worked for Kübel as a paid employee. Then, in 1892, he was hired to help make models for Samuel P. Langley, aviation pioneer and Secretary of the Smithsonian Institution. Eventually Kramer progressed to building delicate instruments for measuring the heat radiation of the sun, with which Langley was experimenting. He continued to work in the same shop at the Smithsonian Institution under Langley's successor, Charles G. Abbot, until he retired in 1953. Kramer kept with him a small neatly boxed lodestone, which he highly prized and described as the graduation present he received from Kübel to mark the completion of his apprenticeship. Kramer kept the lodestone handy for magnetizing compass needles.⁹ (Figure 10)

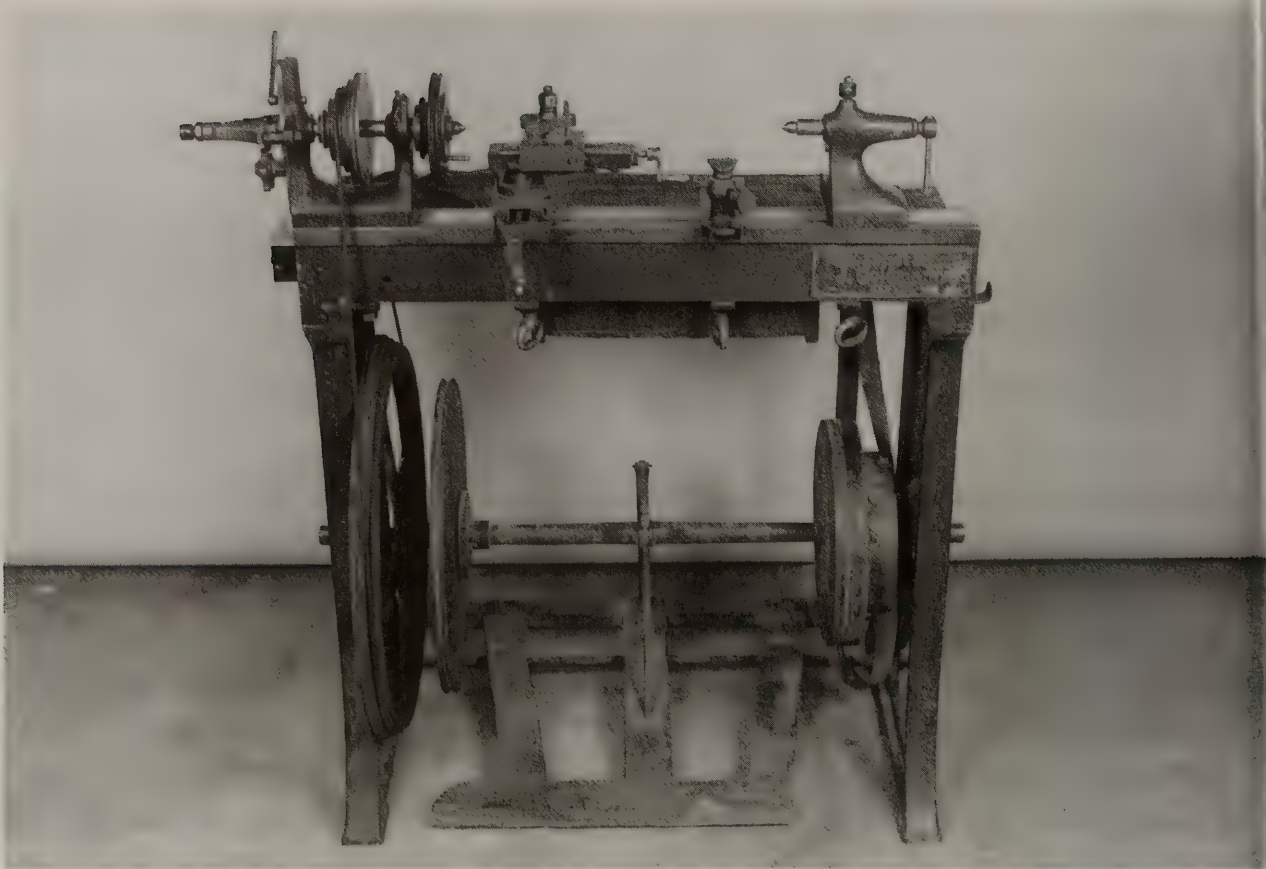


Figure 8. Edward Kübel's screw-cutting lathe, labelled "Vorm: August Hamann/ J. Goldmann Berlin". Gift of Frank A. Taylor. National Museum of American History, Smithsonian Institution.

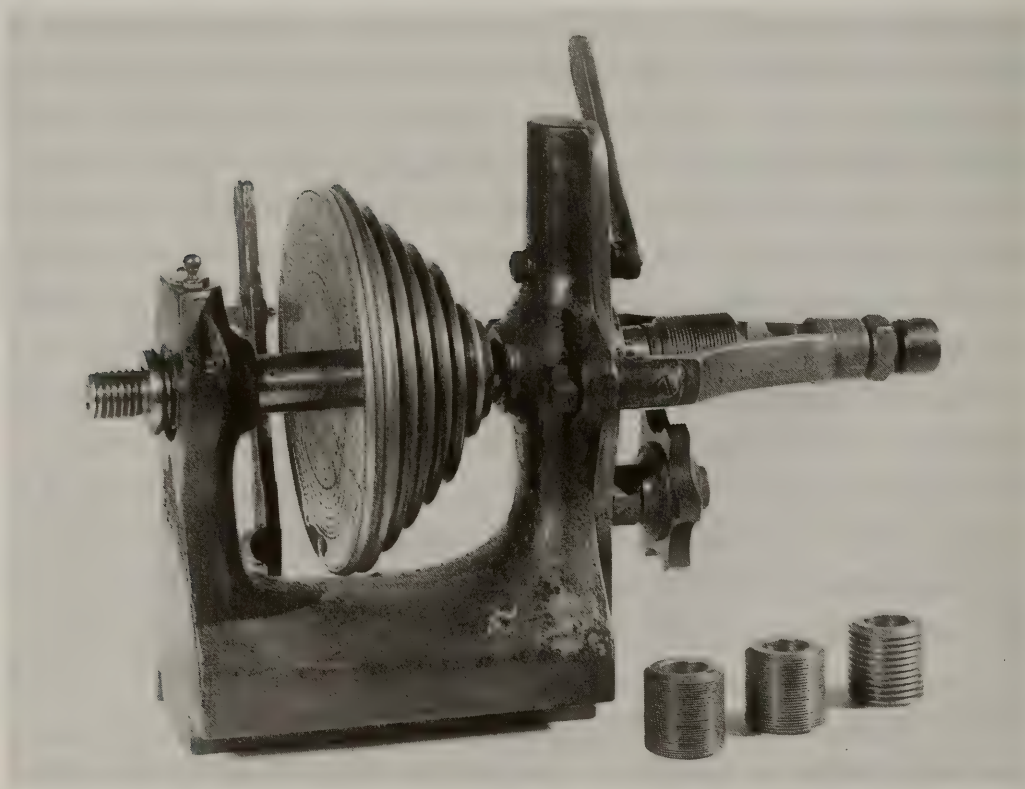


Figure 9. Headstock of Edward Kübel's lathe. National Museum of American History, Smithsonian Institution.

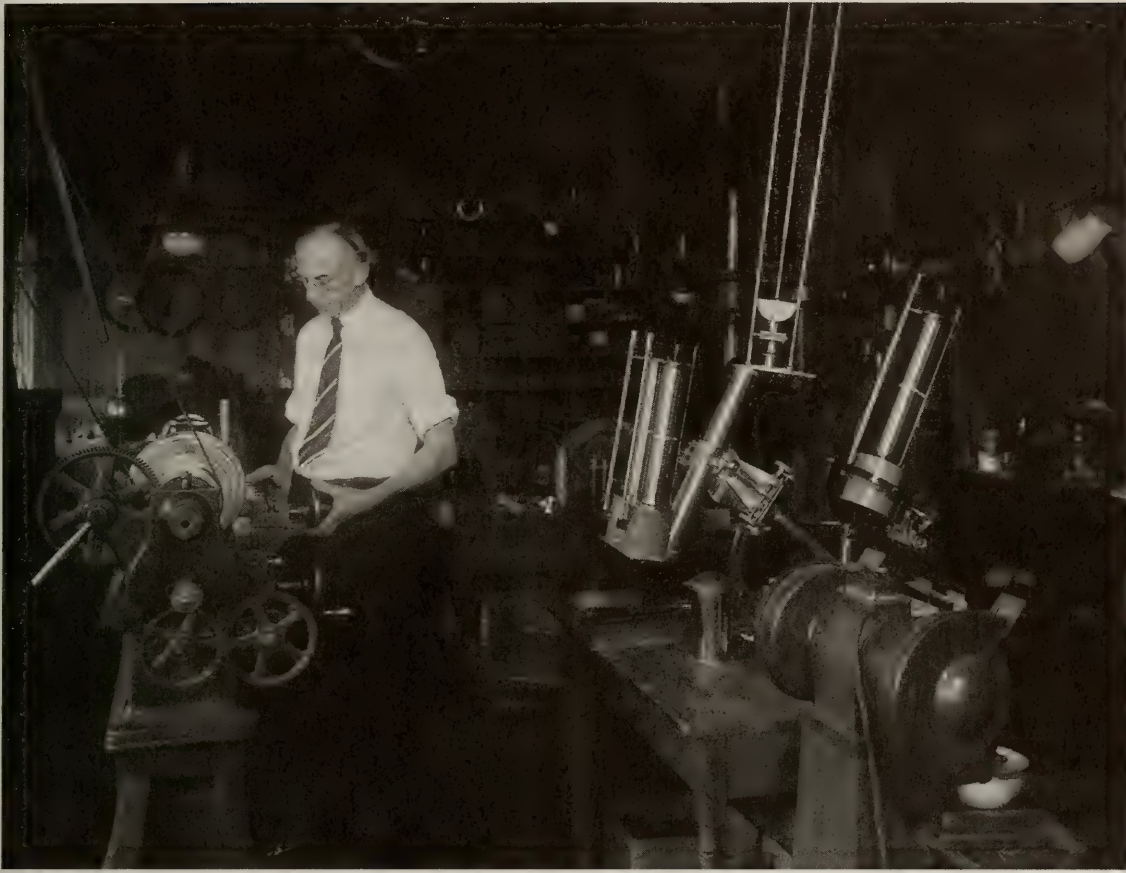


Figure 10. Andrew Kramer, shown in the instrument shop of the Smithsonian Institution's Astrophysical Observatory, in about 1959.

Meanwhile Edward Kübel's wife, Josephine Hartbrecht Kübel, had her own program of apprentices. She aided young German women to immigrate and become established in the United States. These young women were willing to be trained and to begin as domestic servants. They probably were recommended by Josephine's friends in her native Eberbach, Baden. They were trained as working members of the Kübel family, and when they had become fully trained and practiced in the English language, they found ready employment.

In time most of the young women married, and in later years two or three of them who were of an age with Josephine and Clara Kübel would return to visit and to show their children. It was family lore that Josephine Hartbrecht Kübel eventually became disenchanted with this mission when some of her trainees left before she considered them to be fully trained, and she discovered that a neighbor a few houses away was operating an employment agency from her house and was finding work for the trainees for a fee.

In about 1882, the Kübels acquired new neighbors when Nathaniel Terry Taylor II rented a newly constructed house at 332 First Street N.E. and moved in with his wife and three children. Taylor, formerly a Detroit banker who had been ruined in the collapse of his father's bank in the panic of 1873, had come to Washington as a representative of *The Detroit Free Press*. When the Taylors arrived at First Street, their son Augustus

was thirteen and the Kübel's daughter Josephine was ten. In 1895 Josephine and Augustus were married. In writing about his life much later, Augustus Taylor remembered First Street as a mud road with cobblestone gutters, and that Roth's brewery was on the same block.

Edward Kübel continued to make instruments principally for the Federal government including its agencies in the states. His major clients were the Coast Survey and the Lake Surveys, for which he produced telescopes, transit instruments, dipeidoscopes, theodolites, solar attachments, prismatic transits, altitude instruments, gravity pendulums, leveling instruments, gradientors, sextants, magnetometers, spectrometers, spectroscopes, and micrometers, among others. (Figure 11)

One of the instruments made by Edward Kübel for the Coast Survey in about 1875, is presently in the collection of the Smithsonian Institution, transferred from the Geological Survey in 1907. It is an 8-inch theodolite having a graduated circle reading by vernier to 10 seconds, and a telescope 18 inches in length with extra eyepiece, sunshade and spirit level. The diagonal reflector slides over the telescope's objective and was used as a reflector for night work, a lamp or lantern being held near it. It was described in the records of the Geological Survey as being of "a type used by Wheeler, Hayden, Powell and the Geological Survey until 1900, after which it was discarded for a new style, which read by micrometer to 2 seconds of arc. Instruments of this general character are used all over the world for measuring horizontal angles between distant points. Bench marks thus established by triangulation and completed by precision leveling became controls for detailed mapping."¹⁰ (Figure 12)

Among Kübel's most popular products was a relatively inexpensive heliostat commonly used by microscopists and photographers. It is an instrument featuring a mirror moved by clockwork for reflecting the sun's rays in a fixed direction. Kübel's heliostat was designed and patented by Reuel Keith (1826-1908). Upon graduation from Middlebury College in 1845 at the age of nineteen, he found employment as an astronomical observer at the Naval Observatory in Washington. After leaving the Observatory in 1853, Keith worked as a government surveyor until he resigned on July 11, 1856. In the early 1870s Keith was identified as a "professor of mathematics" living in Georgetown.¹¹ (Figure 13)

The invention was announced in *The American Naturalist* in 1877:

KEITH'S HELIOSTAT. — A new heliostat, designed by Professor Keith, is now made by Edward Kübel, of 326 First Street, Washington, D.C. It is an excellent model, simplified without loss of efficiency, and no doubt the best instrument for the use of microscopists who require direct sunlight, for photography, blue-cell work, or any other purpose. It seems a full substitute for the expensive imported instruments. Its cost is \$50.00.¹²



Figure 11. Convertible double gravity pendulum made by Edward Kübel for the U.S. Weather Bureau. National Museum of American History Cat. No. USNM 316,876.

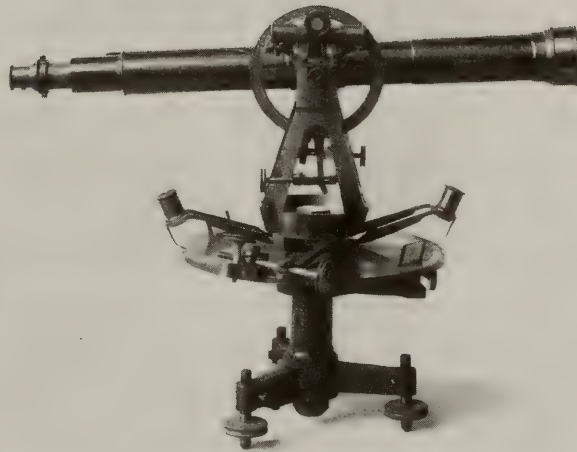


Figure 12. Surveyor's theodolite for measuring horizontal and vertical terrestrial angles. Serial number 172, made by Edward Kübel c. 1875 for one of the Federal geological and geographical surveys of the territories.

The instrument was advertised variously as "Keith's Heliostat" or "Keith's American Heliostat." One of the first of the "Keith's Heliostats" made by Kübel was purchased by Dr. Joseph J. Woodward, Assistant Surgeon of the Armed Forces Institute of Pathology. He used it at the Army Medical Museum in the mid-1870's for photographing histological preparations by sunlight. His use of it was described in *The American Journal of Science and Arts* (September 1866) and in his report on an improved method of photographing histological preparations by sunlight that was published on June 9, 1871.¹³

In 1878 this heliostat owned by Woodward was borrowed by Albert A. Michelson, a young instructor at the U.S. Naval Academy. Michelson used it for his earliest experiment with the speed of light, the circumstances of which were reported in an article about his experiences while teaching his first class at the Academy. He had just returned



Figure 13. Ernest Kübel's advertising brochure for his "Keith American Heliostat."

from a cruise on the frigate *U.S.S. Constellation* in the winter of 1877-1878, when Commander William Sampson assigned him to teach a physics course for advanced students at the Academy, suggesting that he begin with a demonstration of Foucault's measurement of the velocity of light, made with a rotating mirror. Although Michelson protested that he knew little about the method or background of the experiment, he was advised to brush up and take over the class.

As Michelson prepared for his first class, he was astonished to learn that only three men in all of history — the French physicists Armand Hippolyte Luis Fizeau, Jean Bernard Foucault, and Marie Alfred Cornu — had ever attempted to find the speed of light by a terrestrial measurement. In the course of demonstrating the method used by Foucault, Michelson discovered certain faults in his procedures. It was essentially by the intro-

duction of a lens between the rotating and plane mirrors that Michelson was enabled to increase the path of light to 1000 feet, permitting a greater deflection of the returning beam. To assemble the necessary equipment, he ransacked every laboratory storeroom at the Academy and set his students to work constructing mountings and adapting all existing apparatus to his purpose.¹⁴

Finally, Master Michelson wrote to the Army Medical Museum in Washington in March 1878 and requested the loan of Woodward's heliostat for his experiment on light. In view of the common use of the heliostat in Michelson's time, the young scientist would naturally think of it as a means of providing the steady beam of light he would need in his experiment. Accordingly, the instrument was loaned, and although Michelson's resulting apparatus was rudimentary at best, having been assembled by himself at a cost of ten dollars, his demonstration succeeded. He returned the heliostat in July, commenting on the correctness of its operation. "I am glad to learn of the successful termination of your experiment," Woodward wrote, "and can assure you that the maker of the little instrument will be pleased when I tell him of the praise you bestow upon it." Several months later Michelson again wrote to Woodward requesting the price of a Keith American Heliostat. Woodward replied that it "can be obtained of Edward Kübel, 328 1st Street, N.E. in Washington, D.C. The price is \$50.-; mine, with an extra sized mirror, cost I think \$5.- extra."¹⁵

The experiment was reported by Michelson in a one-page paper entitled "On a Method of Measuring the Velocity of Light," published in 1878. Written at the age of twenty-six, it was the first of his many publications.¹⁶ (Figures 14 and 15)

When Edward Kübel opened his state-of-the-art instrument shop at 326-328 First Street N.E. in 1874, it soon became a convenient resource for the specialists in Washington agencies and institutions requiring scientific instruments. Whatever their needs were — consultation, design, estimates of time and costs — all were available within walking distance for most of them.

At the time he established his own shop, Edward Kübel already was a twenty-five year veteran of the instrument-making business, and subsequently his shop enjoyed a decade of free enterprise and prosperity. It lasted until the Federal government began to acquire the land it required for the construction of the Union Station, the railroad tunnel to the south, the first Senate Office Building, and the park between the Station and the Capitol. Edward Kübel was required to sell to the government the land and buildings at 326-328 First Street N.E. which housed Ernest Kübel residence and shop. Inasmuch as the U.S. Geological Survey was one of Kübel's principal clients, it intervened to ensure that Kübel could occupy the premises and continue his business there until demolition of the buildings would begin. Consequently, Ernest Kübel became an employee of the Geological Survey and for the next six years, from 1884, the Survey became the nominal operator of his business.¹⁷

Edward Kübel resigned from the Geological Survey in 1892 and appears to have



Figure 14. A "Keith American Heliostat" made by Edward Kübel for Dr. Joseph J. Woodward of the Surgeon General's Office and borrowed by Master A. A. Michelson.

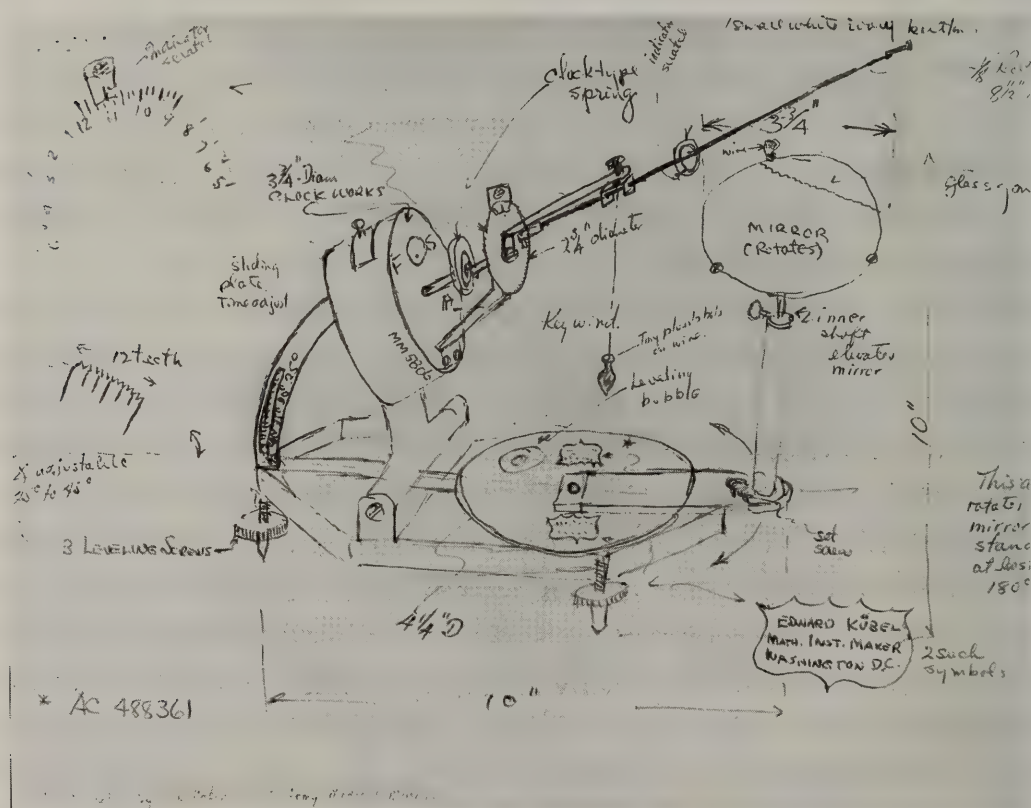


Figure 15. Explanatory drawing of heliostat made by K. H. Robinson of the Army Medical Museum.

relinquished at the same time the conduct of his shop's business to his son, Ernest. Edward Kübel died in 1896. Funeral services were held at the family residence at 326-328 First Street N.E. and he was buried in St. Mary's German Catholic Cemetery in the Kübel-Hartbrecht plot. Edward Kübel's widow and his son Ernest were named executors of his estate. In his last will and testament, dated December 24, 1895, Edward specified that "All the tools, implements, and machinery used by me in my business, I give and bequeath to my son Ernest Kübel." His German instrument maker's screw-cutting lathe also passed to Ernest. Edward bequeathed the house at No. 327 First Street N.E. to his daughter Josephine, who was married to pharmacist Augustus C. Taylor, and No. 323 he left to his younger daughter, Anna Clara. He also left to Ernest the middle one of three houses he owned, his home at 325 First Street N.E. Ernest continued the instrument-making business in the same location until he moved his shop to a new building erected in the rear of the house at 325 First Street N.E.¹⁸ (Figure 16)



Figure 16. Monument to Edward Kübel in St. Mary's German Catholic Cemetery, Washington, D.C.

CHILDREN OF EDWARD KÜBEL

Who Pursued Careers Related to Science and Technology

A number of Edward Kübel's descendants also engaged in occupations related to science and technology in one form or another. The oldest of these was **Edward Frederick Kübel** (1854- ?), son of Edward Kübel's first marriage, who was born in Washington on April 22, 1854, and as a young man moved westward to the Washington Territory. Olympia was the first of the cities on Puget Sound to be equipped with a telegraph connection and it was said that the first message sent over the newly installed line from Washington, D.C. announced the re-election of Abraham Lincoln. Young Kübel was hired as its first telegraph operator, and apparently kept the position for some time.

Meanwhile, in the little community of Steilacoom, a young woman named Clara Viola Light had been taught to use the telegraph, and to while away the tedious hours she and Kübel frequently practiced by exchanging a variety of messages. These brisk telegraphic communications eventually changed from business to personal and finally to romantic conversations. It was some time before they met, however, but not long after they did, they were married, on May 8, 1879. Soon thereafter Kübel was promoted to a better position and subsequently they moved to San Francisco.¹⁹

Stephen Joseph Kübel (1858-1936), the eldest son of Edward Kübel and his second wife, Josephine Hartbrecht Kübel, was born in Washington on April 2, 1858. He attended private and public schools in Washington, including Gonzaga College High School, and continued his study of music at the Scharwenke Conservatory of Music in Berlin. Being also gifted in drawing, while in Berlin he became interested in the art and science of cartography and map engraving. In later years Stephen would refer to the period from 1874 to 1878 as the years during which he devoted himself to mastering cartography and map engraving. (Figure 17)

Back in Washington once more in 1875 at the age of seventeen, Stephen was employed at the U.S. Geological and Geographical Survey of the Territories. This was one of the direct predecessor agencies of the U.S. Geological Survey with which Stephen would later enjoy a career of forty years. In 1876 he joined the staff of the Hydrographic Office of the U.S. Navy as a cartographer. He returned to Berlin for two years in 1883-1885 to serve in the cartographic division of the Prussian general staff where he had the opportunity to study alternative processes of map reproduction. While in Berlin Stephen married Louise Griffith of Milford, Delaware on July 5, 1884. Upon their return to Washington, Stephen resumed his employment with the Hydrographic Office.

For three years from 1887 Stephen worked independently employing his own staff of engravers and printers. He received contracts let by the Public Printer and produced satisfactory work for the Survey, the Coast and Geodetic Survey and the Hydrographic Office. On February 14, 1890 Major John Wesley Powell, then director of the Survey, appointed Stephen Kübel Chief Engraver of the U.S. Geological Survey to organize a map production plant. It was from this beginning that subsequently grew the estab-



Figure 17. Portrait of Stephen Joseph Kübel.

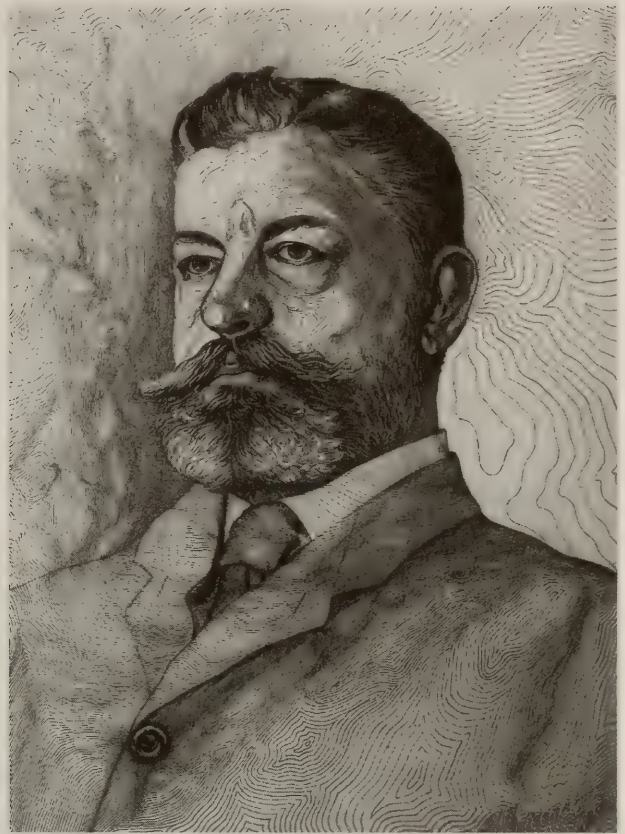


Figure 18. Unusual portrait of Stephen Joseph Kübel as Chief Engraver by A. R. Meissner, 1910, incorporating geodetic contour lines.

lishment he created and that he directed until his retirement forty-two years later. His starting salary was \$2,400 a year. During the reduction-in-force that occurred in 1892, Powell reduced his salary to \$2,200, but restored it to the original amount in the following year.²⁰ (Figure 18)

In early 1901, at the request of its division of graphic arts, Stephen Kübel prepared a special exhibition for the Department of the Interior to demonstrate the Survey's methods of surveying, computing, drafting, printing, and distributing of topographic and geologic maps. The exhibit was displayed that summer at the Pan-American Exposition held in Buffalo. It was while visiting the Exposition on September 6th that President McKinley was shot by an anarchist and died a week later.

In 1909 Stephen Kübel was sent to the International Map Committee meeting in London as the United States delegate, and from 1911 he was listed also as chief of the Geological Survey's Division of Engraving and Printing, responsible for the production of maps by copper engraving, with a salary peaking at \$5,600 in 1928. His graphic arts exhibits for expositions held in the United States and overseas earned him many medals and diplomas. In the opinion of one of his former associates (a man who established national map making programs for a number of major countries), the quality of the engraved maps of the USGS set the standard for the world. It was a matter of family

pride that Stephen Kübel was a handsome man and that his portrait was printed in the “encyclopedia” — the identity of which not presently known — as the example of the typical Bavarian male. (Figure 19)

Music was a high priority in Stephen’s life. He was widely recognized and respected as an organist and church choir director, and a beautiful music room in his handsome home at 10th and East Capitol Streets N.E. was in frequent use for sessions of chamber music with friends whose company he enjoyed. He was an active member of the Capitol Yacht Club and his long, twin-engined Hudson River glass cabin cruiser, the *Louise K*, was a conspicuous part of the evening and weekend boating scene on the Potomac. Stephen Kübel retained the position of Chief Engraver until his retirement in 1932. He died in Washington on March 2, 1936.²¹

Ernest Philip Kübel (1864-1936), the second son of Edward Kübel’s second marriage, and Stephen Kübel’s brother, was born in Washington on June 3, 1864. After attending local schools, he served an apprenticeship with his father and continued to work with him until the latter’s retirement. On June 6, 1894 Ernest married Pauline A. Lerch in St. Mary’s German Catholic Church in Washington, and they became parents of two daughters, Marie and Margaret. Following his father’s retirement in 1895, Ernest succeeded to the business, continuing it as before, producing the same wide range of geodetic and astronomical instruments. His name appeared in the city directory for the first time in that year, with his shop address at 326-328 First Street N.E. and his home listed at 325 First Street N.E. (Figure 20)

At various times between 1892 and 1898 Ernest Kübel was engaged by astrophysicist Samuel P. Langley, Secretary of the Smithsonian Institution and administrator of the Astrophysical Observatory, to produce scientific instruments for his pioneering research on solar radiation and human flight in heavier than air machines.²²

Among the instruments that Kübel made to Langley’s specifications was a “galvanometer (tracks)” for the study of solar radiation that Langley had ordered with a due date of April 1, 1892. Further experiments led Langley to cancel the order as the instrument was no longer required, and asked for the return of the drawings. Two years later Kübel produced a seismoscope and a plane table that Langley sent to Japan. In November 1898 Kübel and several of his workmen were employed by Langley to clean and re-lacquer several instruments in the Observatory. In the same year Langley purchased a small photo-siderostat for \$50.00 which subsequently was modified by Kübel in order to reduce a tremor in the mirror support. In addition to two heliostats, Kübel also provided Langley with a mirror 5 inches in diameter and 1/2 inch in thickness for \$2.50 to be used with one of them, in addition to a mirror case, rods and brace and a spectroscope for the other. (Figure 21)

More than two decades after Michelson’s experiment, another heliostat was required for use by the Army Medical Museum’s micro-photographic unit, leading to a request to Ernest Kübel from Dr. William Gray of the Surgeon General’s Office to modify an



Figure 19. U.S. Geological Survey offices in the Adams Building, Washington, D.C. Stephen Kübel is shown sharing his office with his son Herbert.



Figure 20. Portrait of Ernest Kübel, while employed by the U.S. Geological Survey.

instrument they owned for use in the latitude of Manila. Kübel advised that the changes would cost \$20.00. In a letter Major Walter Reed informed the Surgeon General, "I have the honor to state that there is in this building a heliostat arranged for the latitude of Washington, which was formerly used by the late Surgeon J. J. Woodward, U.S.A. I learn that by an expenditure of about \$20.00 this heliostat can be changed to the latitude of Manila, viz:- 14° 36' North. As a heliostat is necessary for the micro-photographic outfit for Manila, I would respectfully suggest that I be authorized to have the above alterations made. A new heliostat would cost about \$50.00."

Reed sent the Medical Department's heliostat to Kübel requesting that it be changed from the Washington latitude, 38° 53' N., to that of Manila, 14° 36' N. and that a 4-inch mirror be substituted for the existing one. Kübel's response was delayed several weeks due to illness. After examining the instrument, Kübel explained that "in using your heliostat to reconstruct it will cost more than I agreed to as it is one of the old style & considerable cost of repair, and partly an experiment." Accordingly, Major Reed ordered a new instrument which was delivered in December 1899.²³

A dirty window in the shop at the rear of 325 First Street N.E. offended the house-keeping sensibilities of Ernest's sisters and they frequently threatened to enter the shop and wash it for him. The dirty window was home to his spiders which wove the webs from which Ernest took the strands he needed for the cross-hairs in the telescopes of the instruments he made or repaired. He nurtured his spiders and stoutly resisted any threats to clean their window. Most surveying instruments employing telescopes require cross-hairs to define their line of sight. Cross-hairs at the time of the Kübels were usually made of very thin wire or a single strand of spider-web. The cross-hairs were precisely and tautly secured in the focal plane of the optical system where the image of view (the surveyor's rod, a light or a star) would appear. The most common configuration is of one vertical and one horizontal cross-hair, intersecting at the center of the focal plane.

Ernest Kübel continued to maintain his own shop for a number of years, producing new instruments and repairing others for the Geological Survey as well as other agencies of the Department of the Interior. His name appeared in the *Federal Official Register* for the years 1901 through 1909 as a Geological Survey "Expert Mechanician" with salary increases from \$1,800 to \$2,400.²⁴ (Figures 22, 23, 24, 25)

When in about 1917 the Department of the Interior completed the construction of its first building at 18th and C Streets N. W., Kübel helped plan an instrument shop which was included in the plans for the building, and held a senior position in its operation. He brought some of the tools and equipment from his own shop to help furnish it, including his late father's instrument-making lathe. After Ernest's retirement from the Department of the Interior, he continued to work in his own shop on special assignment and performed repair work until his death on November 25, 1936, which marked the end of the Edward Kübel-Ernest Kübel instrument making. (Figure 26)



Figure 21. A "Keith American Heliostat" made by Edward Kübel for Samuel P. Langley's experiments with solar radiation. Signed on hour dial and twice on base "Edward Kübel Math. Inst. Maker Washington, D.C." National Museum of American History, Cat. No. USNMo 211,531.



Figure 22. The Hooe Iron Building at 1324-1334 F. Street N. W. in Washington, D.C., where the "National Center" of the U.S. Geological Survey was housed from 1884 to 1917, next to the "new" Ebbitt Hotel.



Figure 23. Entrance to the offices of the “National Center” U.S. Geological Survey in the Hooe Iron Building at 1324-1334 F Street, N. W.



Figure 24. The Adams Iron Building at 1333-1335 F. Street N. W. in which the Engraving and Printing Division of the U.S. Geological Survey was situated.



Figure 25. Print room of the U.S. Geological Survey in the Adams Building.



Figure 26. Building of the Department of the Interior on the block between 18th and 19th and E and F Streets, N.W. Constructed 1915-1917, it served as the “National Center” of the USGS from 1917 to 1974 and is now the General Services Administration Building.

Emil Adrian Kübel (1869-1894), son of Edward Kübel, was born in Washington, D.C. on April 15, 1869. He was an accomplished violinist and took his music seriously. He enjoyed popularity for his solo performances at music club recitals and at the engagements of the dance orchestras with which he played. He had an antic side exemplified by his sledding down the 13th Street hill on his fiddle case. He chose dentistry to be his life's work and thus is included among his father's descendants who pursued scientific interests. He died in Washington on January 19, 1894 at the age of twenty-four.

From the mid-nineteenth century, Edward Kübel's family and descendants were actively engaged not only in the activities and social life of the German community in Washington, which had been founded in large measure by the immigrant scientific instrument makers who came to the United States to work for the U.S. Geological Survey, but also in the city at large. Edward Kübel's children, including those not particularly interested in science or technology, actively participated in the music life of the city, particularly in church music.

GRANDCHILDREN AND GREAT-GRANDCHILDREN OF EDWARD KÜBEL

Who Also Pursued Careers Related to Science and Technology

GRANDCHILDREN

Herbert Graham Kübel (1888-1918), Stephen Kübel's son, was the first of the third generation, born in Washington on February 19, 1888. Following an education in local schools, in 1910 he spent a year in Germany studying photo-mechanical engraving techniques with the firm of Klimsch & Co. in Frankfurt. Returning to the United States, he was employed by the U.S. Geological Survey for several years. In World War I, Herbert became a pilot in the U.S.A. Aviation Corps with the rank of 1st Lieutenant in the Corps of Engineers. He was engaged in balloon and aeroplane survey mapping at the Signal Corps Aviation School at Call Field, Wichita Falls, Texas. Becoming ill with pneumonia in the course of his work, he died on December 30, 1918, and was buried in Arlington National Cemetery.²⁵ (Figure 27)

Edward Carrier Taylor (1897-1982) grandson of Edward Kübel and son of Augustus C. And Josephine Kübel Taylor was born at 327 First Street N.E. on February 2, 1897. He attended public schools and after graduation from McKinley Manual Training High School he worked as a machinist at the Firth-Stirling plant in southeast Washington, making munitions for the British Army. When the United States entered World War I, Taylor enlisted and served most of the war with the French Army in advanced positions as an ordnance sergeant in charge of a small mobile machine shop repairing and re-issuing American small arms used by the French.

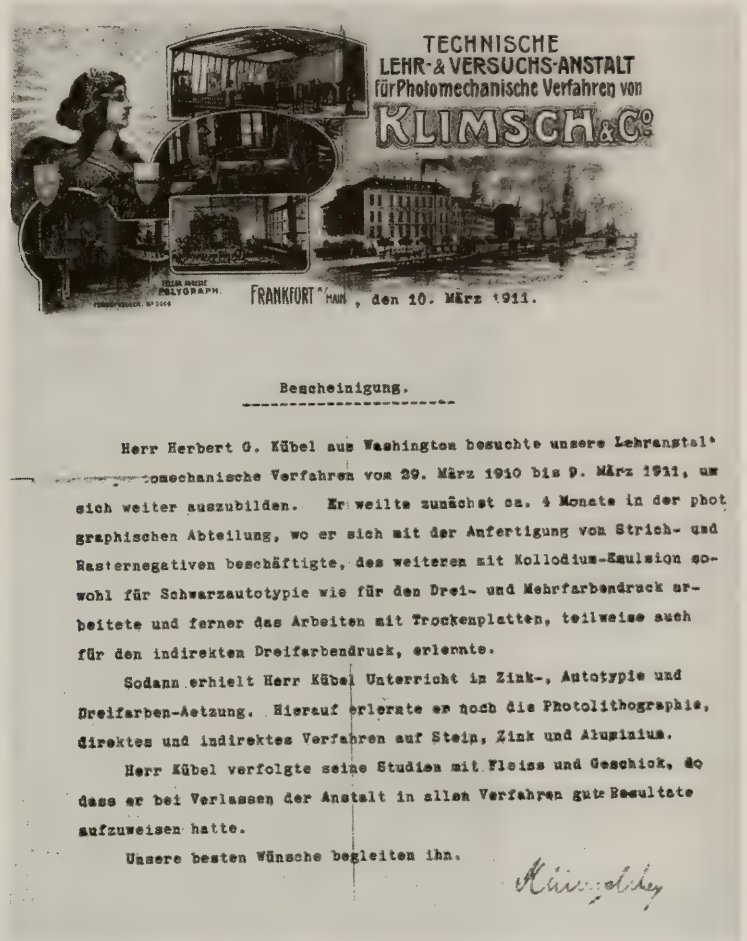


Figure 27. Certificate issued to Herbert G. Kübel for completion of one year of studies in photo-engraving at Klimesch & Co. In Frankfurt, March 10, 1911.

After the war's end Taylor obtained the degree of B.S. in Mechanical Engineering at the Catholic University of America, and upon graduation he was employed by the Riley Company in Worcester, Massachusetts, makers of mechanical coal stokers for firing the steam boilers of power plants and other large users of steam. After several years with Riley, Taylor recognized the need for an industrial stoker that was smaller than the smallest of the Riley line. Taylor designed the stoker he had in mind, and when Mr. Riley decided that it was for a market in which he was not interested, Taylor and a Riley colleague, Wilbur Whitty, left Riley's employ and formed the Whitty Company. Their first plant was one floor in a loft building on the Boston waterfront.

Taylor devoted his entire career to development of the Whitty Company. After Whitty left the Company amicably in the early years to seek his fortune in New York, the company weathered the Depression years and prospered during World War II and the postwar years. Later, when "cheap oil" destroyed the market for coal-burning equipment, Taylor expanded the company's line of fans, flue dampers, and screw conveyors that he had designed as accessories for the stoker. After partial retirement due to illness, Taylor sold the business to a prominent manufacturer of steam boilers. He died in Florida in 1982.

Frank Augustus Taylor (1903-), grandson of Edward Kübel and son of Augustus C. Taylor and Josephine Kübel was born in Washington at 327 First Street N.E. He attended public schools and worked in his father's drug store. Graduating from McKinley



Figure 28. Lieutenant Herbert G. Kübel (facing forward) at airbase about to make a balloon ascent.

High School in February 1921, he obtained work with a U.S. Geological Survey mapping party in Pennsylvania. In 1922 he was employed by the Smithsonian Institution to maintain exhibits and to make models for new displays in the ageing Arts and Industries Building, a part of the U.S. National Museum.

There Taylor joined a group determined to improve this already popular museum. He also enrolled in evening classes at the George Washington University. Later Taylor earned the B.S. degree in Mechanical Engineering from the Massachusetts Institute of Technology (1928) and the LL.B degree from Georgetown University Law School (1934). He was promoted to curator of the Division of Engineering in 1932 and participated in two successful Federal make-work projects of the Depression years which extended the Smithsonian's outreach and preserved useful historical records. (Figure 28)

After World War II Taylor directed the program to revitalize exhibits in the National Museum and initiated the planning for a new building for the museum still housed in the Arts and Industries Building. In 1958 the museum was named the Museum of History

and Technology with Taylor as its director. The building for the Museum of History and Technology was opened in January 1964. Soon after the opening of this museum, Taylor became director of the U.S. National Museum. Later, when all museums of the Smithsonian were individually named national museums, the MHT was named the National Museum of American History and Taylor became Director General of all the Smithsonian Museums. He retired in 1971 but continued on as an adviser until 1984.

In 1989 the Regents of the Smithsonian named a hall in the National Museum of American History "the Frank A. Taylor Exhibition Gallery." Among other awards that Taylor received are the Joseph Henry Medal, the Katherine Coffey Award, the National Civil Service League Career Award and the Philippine Liberation Medal with one Bronze Star.²⁶

Elizabeth Josephine Taylor (1906-1986), granddaughter of Edward Kübel and daughter of Augustus C. and Josephine Kübel Taylor, was born at 327 First Street N.E., Washington, D.C. on January 4, 1906. She attended public schools on Capitol Hill and upon graduation from McKinley Manual Training High School she had earned a scholarship to Syracuse University. Her parents urged her to consider a college closer to Washington and she entered the Maryland Agricultural College at College Park. She was active in student affairs including a substantial role in promoting and planning the construction of the AOP sorority house. This was one of the first constructed during the enlargement of the campus that was soon to become the University of Maryland.

After graduation Taylor taught science at the Calvert County High School in Prince Frederick, Md. Although she taught for only two years, Taylor always recalled the experience as a rewarding one, taking particular pride in the fact that the legendary and long serving Comptroller of the State of Maryland, the late Hon. Louis L. Goldstein, was a student in her class. Mr. Goldstein remembered her and invited her to the fifty-first reunion of the class, which he hosted at his estate, Oakland Hall.

After returning to Washington and to a job or two in the private sector, Taylor took a position in the District of Columbia government as Statistician in the Health Department. She held the title of Statistician until her retirement, although in later years she was conducting a substantial part of the department's administration. During World War II, Taylor devoted most of her weekends to work at the USO. She was unmarried, and died in 1986.

Edward Kübel Dougherty (1912-), grandson of Edward Kübel and son of Edward F. and Clara Kübel Dougherty, was born in Washington, D.C. on December 17, 1912. He completed eight years at St. Paul's Parish Elementary school and four years at St. Johns College High School, both in Washington. At the Massachusetts Institute of Technology, he graduated with a degree of B.S. in Electrical Engineering. He completed his education at the University of Pennsylvania's Wharton School with the degree of Master of Business Administration.

Dougherty was employed by the Westinghouse Electric Corporation for three years (1939-1942) before entering active military service in the U.S. Navy Reserve. He served

as Lt. Cmdr. Contracting Officer, Bureau of Ships, Washington, D.C. from 1942 to the war's end in 1946.

After the end of World War II, Dougherty returned to the Westinghouse Electric Corporation in Philadelphia, engaged in engineering and sales of large electrical apparatus until his retirement in 1975. In retirement, Edward Dougherty lives in Florida. He has three daughters, all married, and four grandchildren.

GREAT-GRANDCHILDREN

John Kübel Farnsworth (1916-), is the first member of the fourth generation of the Kübel family to have distinguished himself in scientific activities. Stephen Kübel's grandson and a great-grandson of Edward Kübel, is the son of John and Florence Kübel Farnsworth. He was born on December 13, 1916 in Shanghai, China, at the Victoria Nursing Home in the English Concession in that city. He attended Bancroft Elementary School, Powell Junior High School and Central High School, all in Washington, D.C., and graduated from the latter in 1935. In World War II he served in England with the U.S. Army. In 1949 the U.S. Air Force recalled Farnsworth to active duty and entered him in a course to provide him with a B.S. degree in Meteorology. This was reduced to a two year course in the essential subjects in order to have him qualified by the American Meteorological Society for certification as a Professional Meteorologist.

This was the beginning of Farnsworth's 15-year career as an Air Force weather officer. He earned a B.S. degree in Meteorology by attending the University of Illinois at Champaign part time while instructing full time at Chanute Air Force Base. In his final assignment at Nellis Air Force Base, Las Vegas, he was successively weather officer, staff weather officer, and weather detachment commander. During the Korean War he served a year as weather forecaster at Taequ Air Base in South Korea. While stationed there he was awarded the Air Force Commendation Ribbon. Farnsworth retired in 1964 after many years of military service.

In retirement Farnsworth has worked in a number of positions reflecting his interest in the environment, notably a position with the San Diego County Air Pollution District.²⁷

Herbert Graham Farnsworth (1919-1981), brother of John Farnsworth, Jr., graduated from McKinley Manual Training High School in Washington. After one year at Devitt Preparatory School, Herbert qualified for the Army Air Corps. He soon became an instructor in the program, which was rapidly expanding to prepare more pilots for a possible war, and later was assigned to train other flight instructors. While based at Turner Field in Albany, Georgia, he set a world record for transitional flying while checking out instructors on B-25 Billy Mitchells; he flew 220 hours in 25 days, made 643 landings and covered approximately 44,000 miles (based on an average airspeed of 200 miles an hour). Turner Field director of training, Colonel Howard C. Stelling, indicated in press

reports that the average flier would take six months to compile as many hours. After the war, Herbert Farnsworth pursued a career in commercial aviation with Delta Air Lines, and frequently was the first Delta pilot to fly new aircraft, volunteering to bring newly acquired equipment from Lockheed and Boeing installations in California to Delta operations headquarters in Atlanta, Georgia. As base air chief pilot for 1,000 pilots based in Atlanta in the 1960s, he continued to perform takeoff and landing checks. In the early 1970s, Delta management decided to relieve base chief pilots of this added instructor workload; Herbert chose to return to flying rather than remain in a desk job, and completed his career with Delta, flying transcontinental and international routes for the expanding airline. He served on Delta's Master Executive Council of the Air Line Pilots Association (ALPA), and represented Delta pilots on contract negotiating committees. He was a member of various ALPA national committees, including the All Weather Committee, developing policies for instrument flying, drawing on his broad experience in testing and training pilots in the use of instruments for navigation. He also contributed to recommendations for Federal regulations of flying with the safety committee of the Air Transport Association. Two of Herbert's children, his daughters Florence Louise Farnsworth and Anne Garry Farnsworth, continued the family's interest in science and technology, both winning positions in National Science Foundation programs in mathematics during high school, both becoming Westinghouse Science Talent Search finalists, and receiving Bausch & Lomb Science Awards at graduation. In the 1970s, Florence created an early computer-based map routing system for the Detroit school system, and in the 1980s, Anne introduced computer mapping for yellow pages usage analysis for the publishing arm of BellSouth Telecommunications.

John Carrier Taylor (1932-), son of Edward Carrier Taylor, grandson of Josephine Kübel Taylor, and great grandson of Edward Kübel, was born in West Roxbury (Boston), Massachusetts on July 5, 1932. After graduating from Boston's famed Latin School, he earned the degree of B.S. in Mechanical Engineering from Cornell University in 1954. Taylor was ordered to active duty with the Army in Korea and there was given the task of designing, building, and then commanding a center that processed Army ordnance parts and vehicles prior to returning them to the United States after the end of the Korean War. After completion of his military service, he entered the employ of the Army and Air Force Exchange Service, where he developed and published standards and criteria for equipment and buildings used worldwide by the Exchange Service. Taylor became the Deputy Director of Engineering for the Exchange Service, where at retirement, he had enjoyed a career of 32 years.

Joan Josephine Taylor (1940-), youngest of Edward Kübel's great-grandchildren is his great-granddaughter, granddaughter of Augustus C. and Josephine Kübel Taylor, and daughter of Virginia M. and Frank A. Taylor. She was born in Washington on December 18, 1940 and attended Lafayette Elementary School and Woodrow Wilson High School. She obtained a degree of B.S. in Anthropology at the University of

Pennsylvania, and went on to graduate studies at the University of Cambridge, England, earning a Ph.D. degree in European Prehistory. She specialized in the application of science to archeology by writing her dissertation on prehistoric goldwork.²⁸

To achieve this, she joined the *Arbeitsgemeinschaft für Metallurgie*, in Stuttgart, Germany, where trace elements in gold objects were being analyzed in an attempt to identify more significant archeological groups. At present she leads a team in a promising research program to characterize and trace gold sources to the prehistoric artifacts made from them by using Laser-Ablation Inductively Coupled Plasma Mass Spectroscopy, this time to ascertain areas of prehistoric manufacture and trade throughout the British Isles and Western Europe.

After being appointed head of the Department of Prehistoric Archeology in 1976, and in between research, she developed the application of science to archeology at the University of Liverpool as the John Rankin Reader of Prehistoric Archeology and Director of the Institute of Prehistoric Sciences and Archeology, now subsumed into the larger School of Archeology, Classics and Oriental Studies. With emphasis in the Institute on the Geophysical applications to archeology, the analytical techniques applied to materials, pollen analysis and Uranium Series Dating, the Department of Archeology was recognized by the British government as being one of the top six in the United Kingdom.

From the middle of the nineteenth century many talented German instrument makers migrated to the United States, to fulfill the need for precision instrumentation for which they had been trained, and provided the foundation for the mechanization of their manufacture. They settled in various parts of the country, including Rochester, New York, St. Louis, Missouri and Washington, D.C., where they worked for the scientists and surveyors employed by the federal government. Among the first immigrant craftsmen was William Würdemann and another was his foreman Edward Kübel, who worked in Washington from 1849 until his retirement in 1892. For some years he was assisted by his son Ernest Kübel who subsequently succeeded him and another son, Stephen Kübel, also played an important role in the development in the USGS. The Kübel might almost be considered a dynasty in the field of scientific endeavors. It would be of interest to know how many other American families can trace a similar continuous involvement with science and technology over a period of one and a half centuries. Accounts of the professions of the subsequent four or five generations unquestionably adds to the endless debate of whether there are generation-linked predispositions or leanings to particular professions, or whether conditional abilities passed on by exposure from an early age through cultural and social experience pre-determines aptitudes and directions towards a profession. Certainly the age-old endless debate among educationalists about "genetic vs. cultural learning" is not resolved here. No doubt both interact, but the nature of the close-knit Kübel families suggests that from a very early age explanations of how things worked, how science could be applied to daily problems, and a general awareness of technology no doubt conditioned each successive generation from a very early age. An attitude also

prevailed within the family that appropriate higher education was essential to bring out the best in an individual's aptitude and ability, ultimately leading to the profession of his or her choice. This encouragement inevitably led successive generations to apply themselves in individual ways to the sciences linked to topography, weather, instrumentation, engineering, and even science-based archeology. As demonstrated by the short professional biographies of subsequent generations, family archives have an important role in tracing this heritage; in this instance, an important contributing factor was the long career of one of Kübel's great-grandsons at the Smithsonian Institution, where Edward Kübel's lathe and some of his instruments are preserved.

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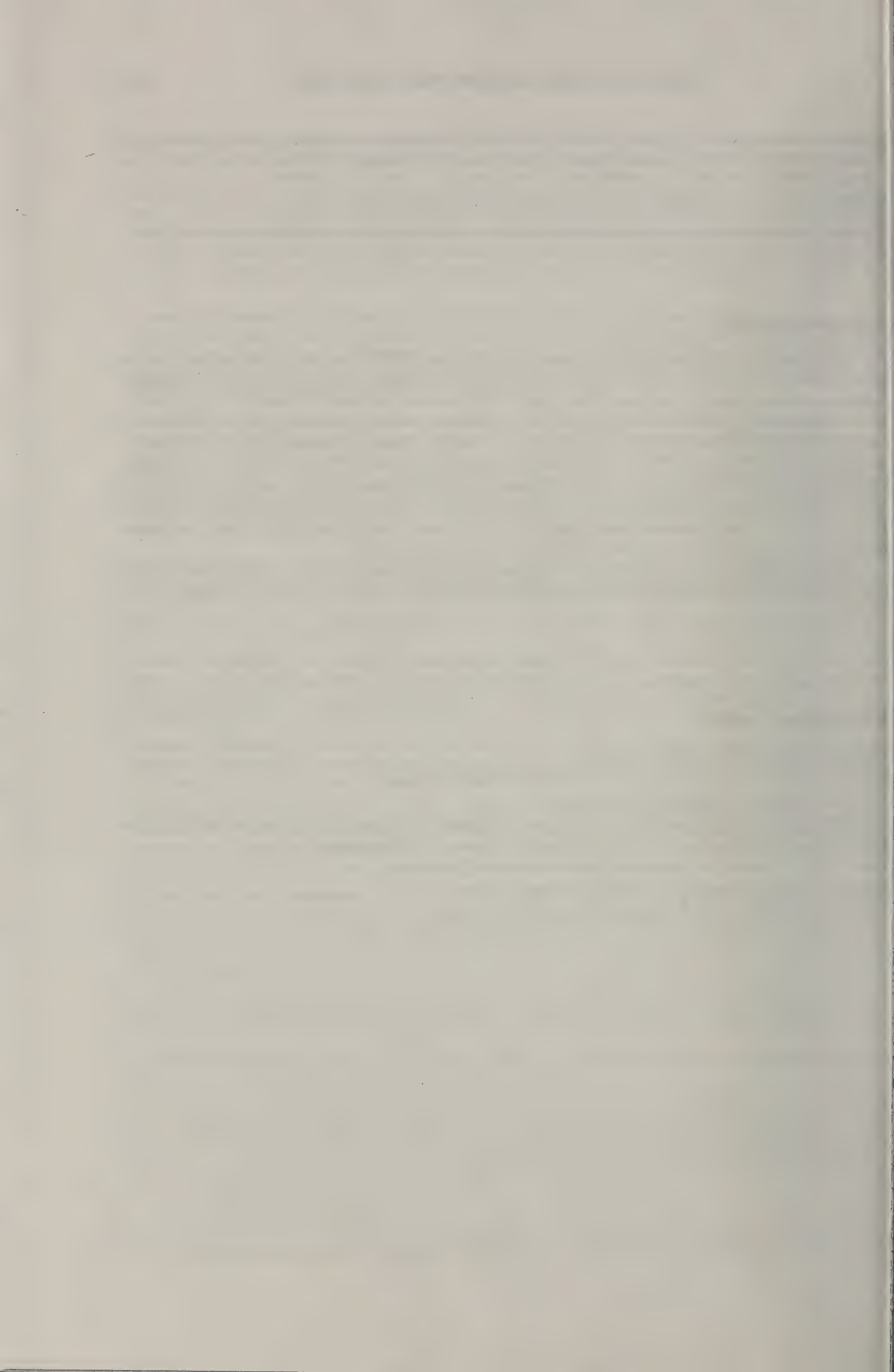
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Gratuity in Nature and Technology

by Paul T. Arveson

Abstract

Frequently in science, we encounter patterns or structures in one field that have parallels in a different, apparently unrelated field. Because of the inherently cross-disciplinary nature of this subject, sometimes the parallels can go unrecognized for a long time. One of these patterns is often referred to as "levels of reality", or "levels of explanation". This "laminar" structure of our knowledge implies that there is some general feature or characteristic that separates systems into distinct and irreducible levels or dualities. Here this feature is identified as what Jacques Monod called gratuity and it brings together in one brief summary a variety of ways in which we observe gratuity in both natural and man-made systems.

Monod's insight was that a living cell is a very special kind of machine, in which its information content is free and unconstrained by the cell itself. In DNA, there is no energetic preference for one set of nucleic acids over any other; the sequence is an arbitrary code, as far as the cell is concerned. Rather, the cell's processes are analogous to the relationship between a computer's software and its material substrate. In a computer, the sequence of numbers and letters in the software are not constrained but are free from the structure of the computer's hardware. So we are faced in these cases with systems that cannot be described in simple mechanistic terms of cause-and-effect. Their behavior is governed not from "below," but rather from "above." In the following sections, several examples of gratuity and its application in widely diverse fields are described.

Introduction

This article draws parallels between the manifestations of "levels" in biochemistry and computer science (computer networks and computers themselves). A common idea found in these fields is Monod's concept of 'gratuity.' Many theories in other fields are not considered here but are recognized to be relevant to this concept, including for example quantum physics (wavelike behavior of atomic interference reported by Berman, 1997), the brain (theory of neuronal group selection, Edelman, 1994), social animals: Holland (1995), ecology: Gell-Mann (1994), and economics: Anderson (1987); Arthur et al. (1997). Technology has drawn many fruitful lessons from biology; it is now suggested that organizational management could also benefit from such cross-disciplinary learning.

Gratuity in Biochemistry

Jacques Monod won the Nobel prize for his elucidation of the process by which gene expression is regulated in biosynthesis, a process called the operon model. I will not describe the whole model here, but quote Monod's own analysis of the concept from *Chance and Necessity* (1971):

"There is no chemically necessary relationship between the fact that beta-galactosidase hydrolyzes beta-galactosides, and the fact that its biosynthesis is induced by the same compounds. Physiologically useful or rational, this relationship is chemically arbitrary — gratuitous, one may say."

We are in the habit of describing chemical processes in terms of cause and effect. That won't work for this process. It is not deterministic in a simple, mechanical way. Monod identifies the relationship as one of "gratuity":

"The fundamental concept of gratuity — i.e. the independence, chemically speaking, between the function itself and the nature of the chemical signals controlling it — applies to allosteric enzymes. ... Between the substrate of an allosteric enzyme and the ligands prompting or inhibiting its activity there exists no chemically necessary relationship of structure or of reactivity. The specificity of the interactions, in short, has nothing to do with the structure of the ligands; it is entirely due, instead, to that of the protein in the various states it is able to adopt, a structure in its turn freely, arbitrarily dictated by the structure of a gene.

"From this it results — and we come to our essential point — that so far as regulation through allosteric interaction is concerned, everything is possible. An allosteric protein should be seen as a specialized product of molecular engineering, enabling an interaction, positive or negative, to come about between compounds that are chemically foreign and indifferent to this reaction.

"In a word, the very gratuitousness of these systems, giving molecular evolution a practically limitless field for exploration and experiment, enabled it to elaborate the huge network of cybernetic interconnections which makes each organism an autonomous functional unit, whose performances appear to transcend the laws of chemistry if not to ignore them altogether."

So the essential aspect of gratuity is a kind of independence or transcendence; the freedom of a system's behavior from being constrained by its parts. Such a system can act to control a signal without altering it, or as a transparent channel for a signal. In biochemical 'signals' of the operon model, the DNA fully determines the products formed, but when they are formed is under the control of a process at a 'higher level' in the system.

"Microscopic cybernetics" is Monod's own phrase by which he suggests analogies between biology and computer circuits. Features of the operon model include positive and negative feedback regulation (enzyme induction and coordinate repression). He even

showed how two interacting operons can form a stable oscillator (just as two dual-input NAND gates can be connected to form a flip-flop circuit):

“... both interactions of the repressor are noncovalent and reversible, and that, in particular, the inducer is not modified through its binding to the repressor.... Thus the logic of this system is simple in the extreme: the repressor inactivates transcription; it is inactivated in its turn by the inducer. From this double negation results a positive effect, an ‘affirmation’.... The logic of biological regulatory systems abides not by Hegelian laws but, like the workings of computers, by the propositional algebra of George Boole.”

This was written in 1970; Monod was already aware of the relevance of cell biology to computer operations via Boolean algebra. Cross-disciplinary research of this kind continues; some of the most interesting work is being conducted by workers at the Santa Fe Institute, including Murray Gell-Mann (1994), Stuart Kaufmann (1996), and John Holland (1996). See also the excellent survey by Waldrop (1992).

To illustrate, the following table shows a scheme that identifies the “levels of organization” of living things.

Table 1. Independent Layers in Biological Systems

- 9. ecosystem with numerous species
- 8. species
- 7. individual organism or phenotype
- 6. organs
- 5. cell and organelles
- 4. nucleus *
- 3. operons and RNA mediated synthesis
- 2. DNA code
- 1. molecules and bonds

* A very recent addition to examples of gratuity is the discovery that a cow egg can support the development of another mammalian species, if its nucleus is substituted for the cow’s (Dominko and First, 1998).

Gratuity in Telecommunication Networks

Gratuity is established in computer network protocols by distributing network functions among a series of layers; wrapping the data in packets with headers containing layer-related information; and limiting interaction between the layers to that involving the headers. In transmission, starting from the top layer, each lower layer adds its own

header to the data sent to it, and on reception each higher layer strips off a header and sends the data to the next layer. These processes are described by various technical terms, but all are related to the general principle of gratuity, where the data are independent of the frame or header. Here are some examples:

- Frame relay, the X.25 standard, creates frames around packets of data.
- Cell relay (ATM, Asynchronous Transfer Mode) adds headers to small packets.
- The Internet Protocol (IP) establishes tunneling of IP packets through foreign-networks.
- Sometimes large data packets have to be broken up to fit through a network, and then reassembled; this is called transparent fragmentation in IP or segmentation in ATM.

All these are equivalent to wrapping a message in a sealed envelope. This is done at the expense of lost bandwidth, but has many advantages: service over a connectionless network; error detection; receipt acknowledgment; standardized packet handling; guaranteed quality of service; security, etc.

Layering also has two distinct advantages for the design of networks: it facilitates development of the protocols, and it simplifies their functional components (hardware and software). Advanced protocols like ATM take thousands of pages to document; such complexity would be impossible for humans to manage without being able to limit the information required at any given layer.

The OSI (Open Systems Interconnection) model is traditionally used to illustrate the arrangement of layers in networks. The identification of functions in each layer differs depending on the particular set of protocols used, because the original OSI model is somewhat idealized. Below is shown a practical example of layer designations, applicable to an advanced network with TCP/IP running over an ATM subnet:

Table 2. Example of Layers in a Computer Network (TCP/IP over ATM).

6. Application layer - HTTP, FTP, Telnet, email, etc.
5. Transport Control Protocol (TCP) Layer - manages the network
4. Internet Protocol (IP) Layer - network addressing and routing
3. ATM Layer - several sublayers for switching and routing
2. Data Link Layer - error detection, framing, flow control
1. Physical Layer - cables, switches, voltages etc.

Gratuity in Computer Technology

Maurice Wilkes, one of the early pioneers of computer science, has recently (1995) written a concise retrospective on its early history. This little book is helpful in separating

significant changes from all the hype and clutter. Wilkes notes three crucial turning points in computer development; all had something to do with gratuity.

Unlike other kinds of machines, a computer's function is to process data; it doesn't matter what physical form the hardware takes, as long as its logic is correct. In describing the conversion of computers from vacuum tubes to transistors, Wilkes remarks on the smoothness of this transition with a beautiful simile: "It was as though the foundations of a cathedral were being wholly renewed, while services were going on in the choir and the organ was playing."

Another achievement led to what Wilkes called "the software avalanche": the appropriate segregation of hardware tasks from software tasks. Some early computers used parallel arithmetic processors in order to save calculation time, at the expense of more complex programming. Later, to simplify programming the change was made to a single CPU to allow a single instruction stream for all operations. Operations were slower, but this saved programmer time. It also "made possible the development of modern software with its layer upon layer of complexity."

A key to this development was the realization that computers could be used to prepare and edit their own programs. The use of index registers allowed subroutines to be called to simplify programming efforts. Then a team led by Grace Hopper at UNIVAC developed a "compiler" that expanded program pseudocode into machine code. Wilkes (1952) independently suggested a similar concept. At that point, languages more readable by humans could be developed, including FORTRAN, COBOL, ALGOL, BASIC, and PL/1 during the 1960s. The syntax of these languages was based on human needs, not the machine's; this is a third historical example of gratuity.

Wilkes' "software avalanche" led to higher-level computer languages, including complex compilers and hardware simulators used to design more advanced computers. Whenever systems support their own growth in this way, the growth rate is exponential. This is why we have observations such as Moore's law, which describes the 'doubling time' of computer processing power every 18 months.

Another significant application of gratuity is the concept of 'object oriented languages' such as Smalltalk, invented at the Palo Alto Research Center in the early 1970s. An object "is a self-contained software package consisting of its own private information (data), its own private procedures (private methods) that manipulate the object's private data, and a public interface (public methods) for communicating with other objects" (Fingar, 1996). In this methodology, a programmer's task is not so much with writing lines of code as with assembling a set of pre-defined objects for a task.

The hiding of internal information within objects is called encapsulation. To use an object, you only need to know what messages the object can accept. The advantage of encapsulation is that objects can be combined, changed, and reused without having to rewrite any internal code. This is clearly an application of gratuity, where the 'insulation' of internal source code from the high-level object language is strictly enforced.

Further layers continue to be developed in computer technology, as the systems become more complex and powerful. The need to sequester and limit information seen by the designer or user continues to be the only feasible way to develop systems of this complexity. Hence, we see system descriptions with increasing numbers of layers. Computer technology using objects is now expanding to create higher levels of sophisticated system “architecture” in organizations. Norman Simenson, a veteran software engineer from the early days at IBM, has recently written a working definition of “architecture” (1997):

“An architecture is a partitioning scheme, or algorithm, that partitions all of the system’s present and foreseeable specifications into a workable set of cleanly bounded ‘buckets’ with nothing left over. That is, it is a partitioning scheme that is exclusive, inclusive, and exhaustive. Ideally, each bucket will be a standalone partition. A major purpose of the partitioning is to arrange the elements in the buckets so that there is a minimum of message exchanges needed among buckets. In both software and hardware, a good bucket can be seen to be a meaningful ‘object’.”

This definition clearly entails gratuity, albeit in different language. Below is a table describing one scheme suggested scheme for layers of information technology that might be deployed in a future business enterprise (upper layers from Fingar, 1996).

Table 3: A Scheme for Layers in an Enterprise Information System

14. Agents: sequencing of workflows, events.
13. Events: representations of actions that initiate or influence business scenarios.
12. Scenarios: Assemblage of entities representing a business function or process (transactions, orders).
11. Entities: tangible and conceptual problem domain subjects (people, trucks), associations (marriage, employment) and roles (manager, clerk).
10. Intrinsic: Technology and problem domain for independent base classes (money, size, etc.)
9. Technology encapsulation: CORBA, DCOM, (persistence, lifecycle, etc.)
8. Object-oriented languages, models, and development environments
7. Graphical user interfaces (computer-human interfaces), input/output data
6. Source code layer (text)
5. Assembler language layer
4. Machine language layer (binary codes)
3. Boolean algebra, binary logic
2. Circuit layer: gate arrays, registers, read-only memory, buses etc.
1. Physical layer: physical laws and materials parameters

The Emerging Language of Gratitude

It is noteworthy that the word 'levels' is a metaphor. Although the word is commonly used to refer to separated functions in complex systems, in most cases the 'levels' do not have any physical existence. In a computer, only the bottom one or two layers are physical; the rest are in software. In the case of computers, it may be more appropriate to use another metaphor, such as a "chain" of functions, or even better, a nested series of "shells," as in a set of babushka dolls. (In fact, in the UNIX context the word "shell" is often used.) In more complex systems, the relationships are more "weblike"; ultimately in our technological systems we are reconstructing ourselves, i.e., our biological bodies and ecosystems.

In network terms we may describe biological gratitude by saying that the DNA is the data packet to be sent; the chromosomes (headers) encapsulate the data, and other top-layer functions control when and how often the packet is sent. This is a "top-down" process. On the other hand, the structure and function of all the products are ultimately determined by the DNA, i.e., "bottom-up." There is an asymmetrical interdependence, or "metadependence" of information coming from above and below the synthesis layer. In computer terms, we could say that the user or the top-level program determines what actions occur, even though we "know" that the immediate cause is electric signals in the physical layer. Among software engineers, this low-level reality tends to be repressed into the unconscious, and in place of the user, new kinds of top-level gratuitous objects continue to be developed, such as "agents," "avatars," "daemons," etc. Perhaps the end-point of "computer system" development is Data, the android in Star Trek — he knows everything, but (unlike HAL of 2001) he has no ambition.

Management Applications: How to Get Organized

There are many other ways in which the concept of gratitude can be observed in nature and technology. Rather than continue with technical examples, I wish to discuss the potential relevance of gratitude to the practical problems of managing complex organizations. In modern enterprises such as the federal government or large corporations, managers often are overwhelmed at the complexity they are expected to comprehend and lead. The common phrase for this is 'information overload' and this may lead to frustration, stress and cynicism. However, nature demonstrates that although such tasks are extremely difficult, they are not fundamentally impossible. They just have to be divided up and delegated appropriately. In the operon model and many other biochemical processes that science has elucidated, gratitude limits information by isolating (or encapsulating) functions from each other, allowing only a few carefully defined inputs and outputs to pass, thus creating "layers." Some kinds of data will pass transparently through a layer; some kinds will originate in each layer. But the net effect is to simplify the entire

system's behavior and its presentation at the top layer, where strategic decisions affecting the entire system can be made — whether that system be a jaguar (Gell-Mann's example) or a corporation's growth strategy.

Taking this lesson from biochemistry and technology, we conclude that managers should not try to 'micromanage' operations of low-level business units on a continuing basis. Rather, they should establish metrics to monitor the efficiency (cycle time, productivity) and effectiveness (relevance to mission or strategy) of each unit. Then they should monitor these metrics, and leave the internal functions to adapt and improve at will (freedom or 'gratuity' is established within each unit). In order to limit the data flows to prevent information overload, measurements should be aggregated at each level of organization. In other words, strategic planning and reengineering studies should find ways to limit data, as well as to deliver it.

Bureaucratic organizations may have over a dozen levels in their chain of command. If a level does not add value (i.e., create new information), it is only a transparent or pass-through channel at best, or an obstruction at worst. This realization is leading many agencies to 'flatten' their organizational structure by removing layers of middle management. In addition to reducing costs, a useful goal of this reengineering process is the appropriate allocation and isolation of functions and simplification of their linkages. By applying gratuity, it is possible at least in principle to build systems or organizations of ever-increasing complexity without getting bogged down in information overload or inefficiency.

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1998 Membership List

- DR. SUHEIL F. ABDULNUR 5715 GLENWOOD RD, BETHESDA, MD 20817 (F)
DR. LEWIS F. AFFRONTI 108 WATerview CIR, FOREST, VA 24551 (EF)
DR. J. FRANCES ALLEN RR1 BOX 9, ROXBURY, NY 12474 (EF)
DR. PHILIP ANDERSON DEPT OF PHYSICS, PRINCETON UNIV, PO BOX 708, PRINCETON, NJ 08544 (LF)
MR. CASPER J. ARONSON 3401 OBERON ST, KENSINGTON, MD 20895 (EM)
MR. COLLINS ARSEM 10821 ADMIRALS WAY, POTOMAC, MD 20854 (EM)
MR. PAUL T. ARVESON 6902 BREEZEWOOD TERR, ROCKVILLE, MD 20852 (F)
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DR. LEONARD BAKER 1014 WALL RD APT F-4, SPRING LAKE HTS, NJ 07762 (F)
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 MR. JEROME GIBBON 311 PENNSYLVANIA AVE, FALLS CHURCH, VA 22046 (M)
 MR. JAMES GIRARD THE AMERICAN UNIV, DEPT OF CHEMISTRY, WASHINGTON, DC 20017 (F)
 DR. HAROLD GLASER 1902 BERRYMAN ST, BERKELEY, CA 94709-1919 (EF)
 PROF. ROLFE E. GLOVER III 7006 FOREST HILL DR, HYATTSVILLE, MD 20782 (EF)
 MR. ALBERT G. GLUCKMAN 11235 OAKLEAF DR, NO 1619, SILVER SPRING, MD 20901-1305 (EF)
 DR. ROBERT L. GLUCKSTERN 801 DROHOMER PL, BALTIMORE, MD 21216 (EF)

- DR. JAMES F. GOFF 3405 - 34TH PL, NW, WASHINGTON, DC 20016 (EF)
- MS. ELAINE KALSTEIN GOLDBERG 719 HARRINGTON RD, ROCKVILLE, MD 20852 (F)
- DR. A. MORGAN GOLDEN 9110 DRAKE PL, COLLEGE PARK, MD 20740 (EF)
- DR. CALVIN GOLUMBIC 6000 HIGHBORO DR, BETHESDA, MD 20817 (EM)
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- DR. VICTORIA C. GUERRERO 10627 PATTERNBOND TERR, SILVER SPRING, MD 20902 (M)
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 MRS. EVELYN S. NEF 2726 N ST, NW, WASHINGTON, DC 20007 (M)

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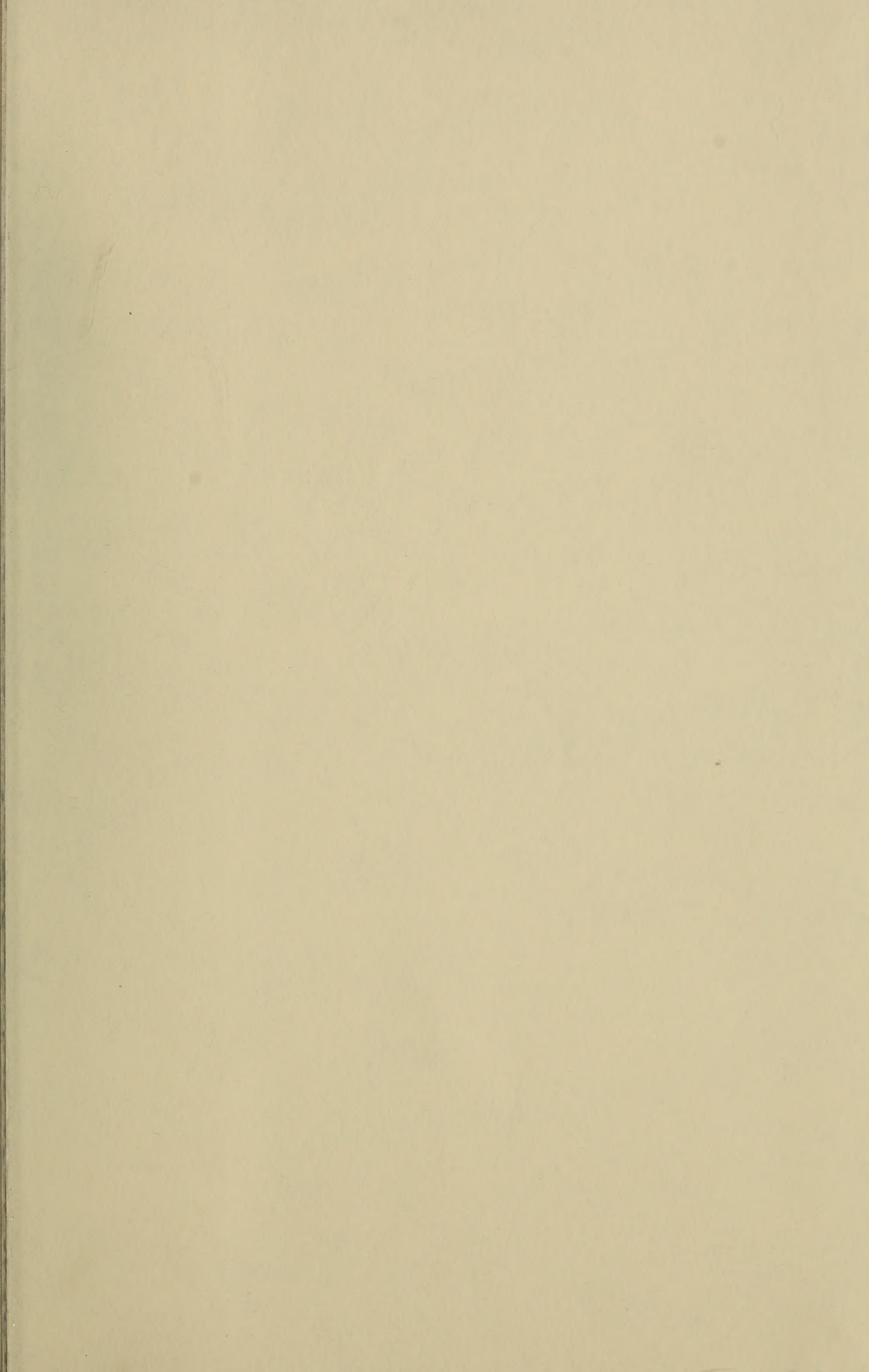
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